TOP SECRET

PIR

PHOTOGRAPHIC INTELLIGENCE REPORT

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ANTISATELLITE/SPACE TRACKING RADAR COMPLEXES

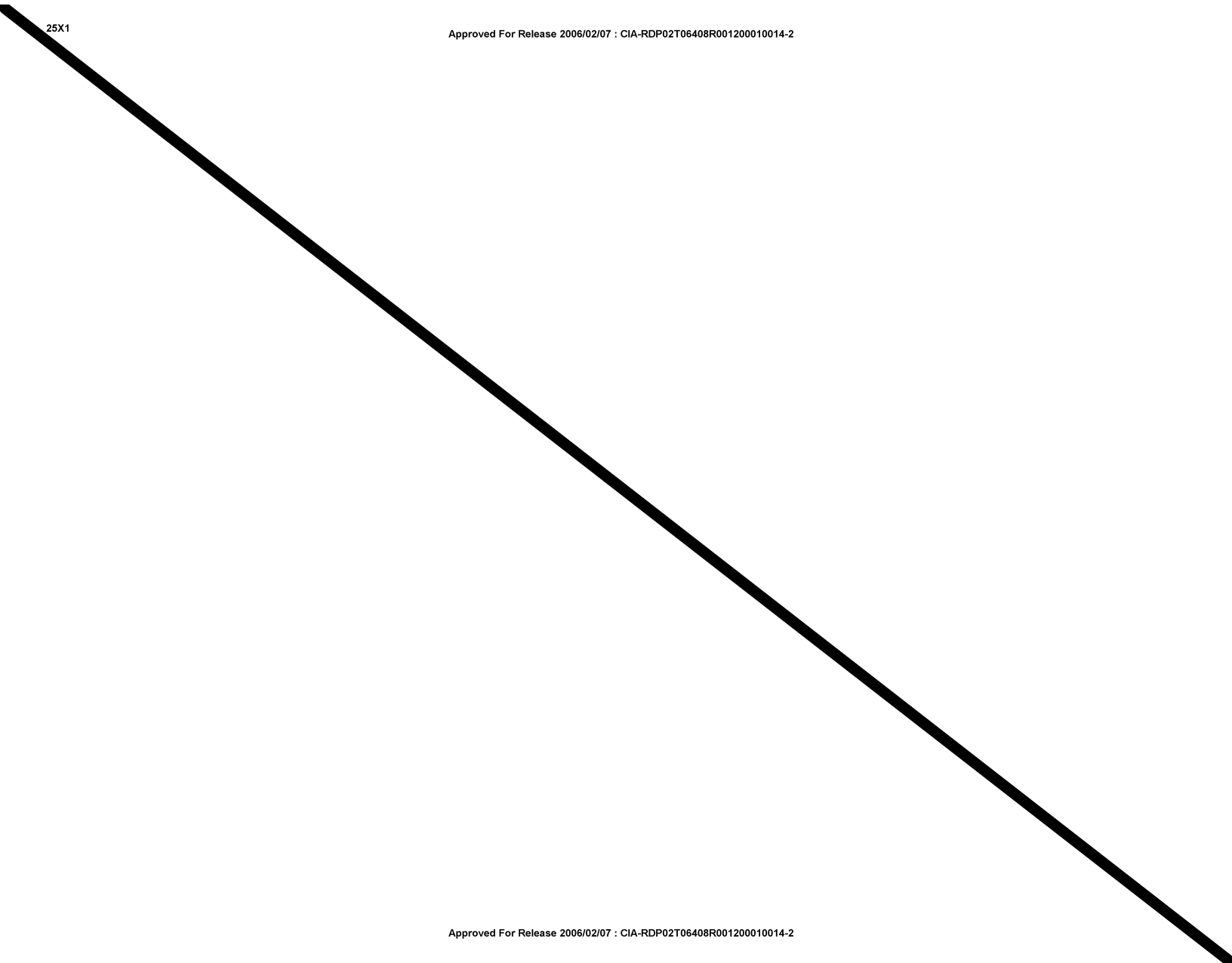
MISHELEVKA AND SARY-SHAGAN, USSR

25X1

25X1

CIA/PIR -71011
DATE OCTOBER 1966
COPY 113
PAGES 31

TOP SECRET



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IMAGERY ANALYSIS DIVISION

ANTISATELLITE/SPACE TRACKING RADAR COMPLEXES MISHELEVKA AND SARY-SHAGAN, USSR

[redacted] 25X1

OCTOBER 1966

CENTRAL INTELLIGENCE AGENCY

PHOTOGRAPHIC INTELLIGENCE REPORT

25X1

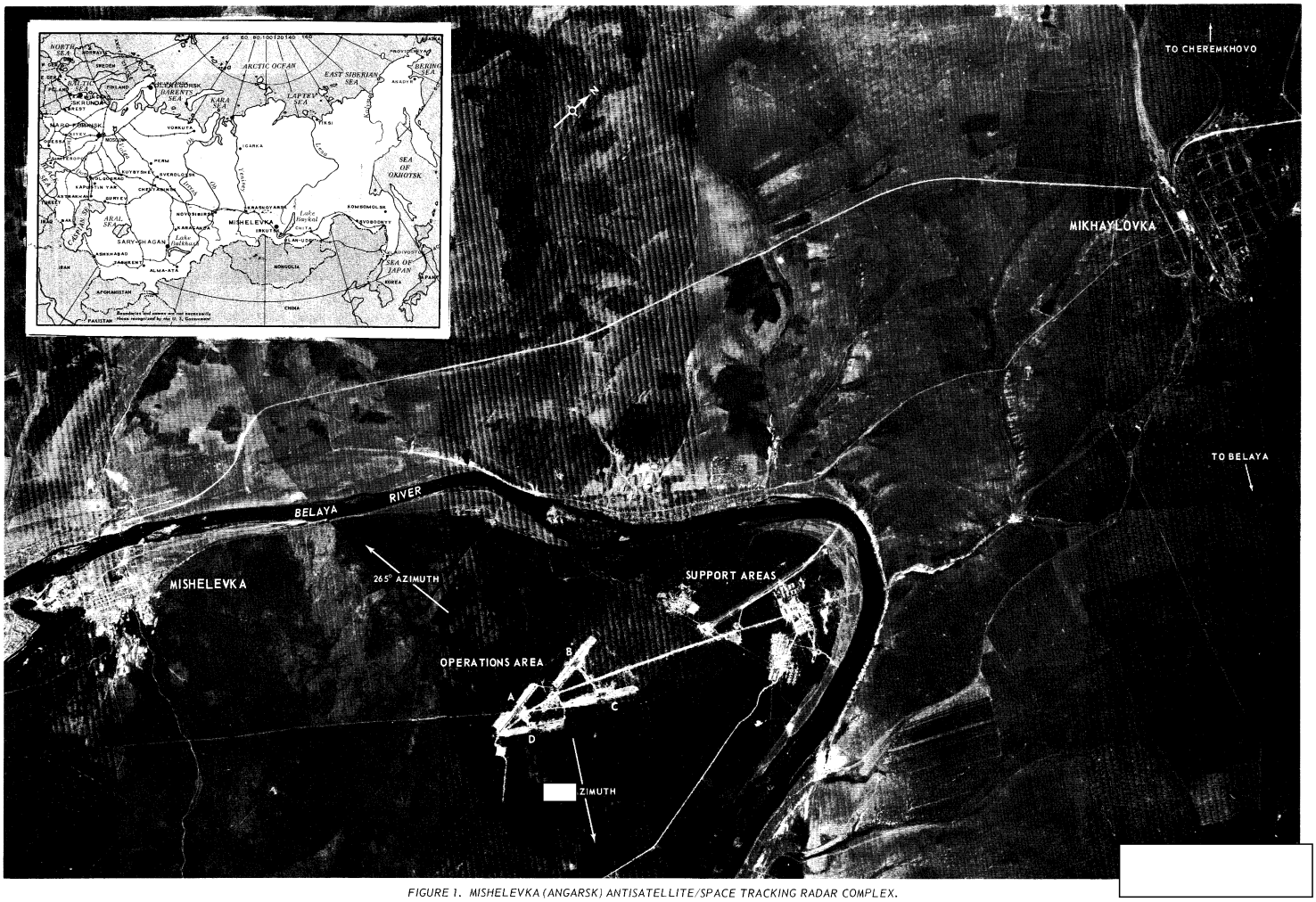


FIGURE 1. MISHELEVKA (ANGARSK) ANTISATELLITE/SPACE TRACKING RADAR COMPLEX.

25X1 [redacted] 25X1

MISHELEVKA (ANGARSK) ANTISATELLITE/SPACE TRACKING RADAR COMPLEX (52-53N 103-15E)

PREFACE

This report is in response to CIA requirement C-SI5-82,970 which requests a detailed analysis of the Mishelevka (Angarsk) Antisatellite/Space Tracking Radar Complex, USSR, (Figure 1) and is based on photography accomplished since This requirement included a request for:

a. Rectified line drawing of the Mishelevka (Angarsk) Dual HEN HOUSE Radar Site.

b. Detailed information on internal construction of the antenna structures.

c. Complete mensural data on each radar.

d. A description of the differences, both internal and external, noted between the radars at Mishelevka (Angarsk) and at Sary-Shagan Antisatellite/Space Tracking Radar Complex at 46-36N 74-32E formerly designated Site 13. This report also satisfied requirement CZ/51/65.

This analysis is presented as a chronological sequel to a previous report, 1/ which provided a detailed analysis of the Mishelevka (Angarsk) and Sary-Shagan installations from negation through

INTRODUCTION

It is believed desirable to clarify certain nomenclature and terminology previously used. This is shown in Figure 2. Inasmuch as the mass of the control building is positioned to the rear of the antenna face, it is considered reasonable to use the words front and rear with respect to the control building and the associated HEN HOUSE structures. Assuming a front facing situation, the HEN HOUSE antenna structures have been designated right and left.

Despite the precedent at Sary-Shagan Radar Complex 1 where the HEN HOUSE transmitter was probably located to the left of the antenna structure, it is believed reasonable to assume that suspect transmitter houses at Dual HEN HOUSE radars are on different sides of the antenna structures, i.e., both are adjacent to the control building. In each case, the suspect terminal houses are at the extreme ends of the Dual HEN HOUSE structures.

To permit an appreciation of the size of these structures, Figure 2 shows a perspective view of a THIN BOY Dual HEN HOUSE Radar and, drawn to the same scale, an American football field.

Between the cut-off photography for this report, the Mishelevka (Angarsk) complex has been covered by 11 missions, two of which were better quality missions than previously available. photography (Figures 3 and 4) was used to produce most rectified line drawings, perspective concepts, and detailed mensurations of the Mishelevka (Angarsk) Complex.

Since photography, the Sary-Shagan Radar Complex has been covered by missions, up to and including the cut-off photography of Within this time span, provided good quality, large scale coverage.

DUAL HEN HOUSE A Operations Area

Control Building. On photography the control building was probably externally complete. Subsequent coverage revealed no changes and coverage confirmed that the building was externally complete.

Antenna Structures.

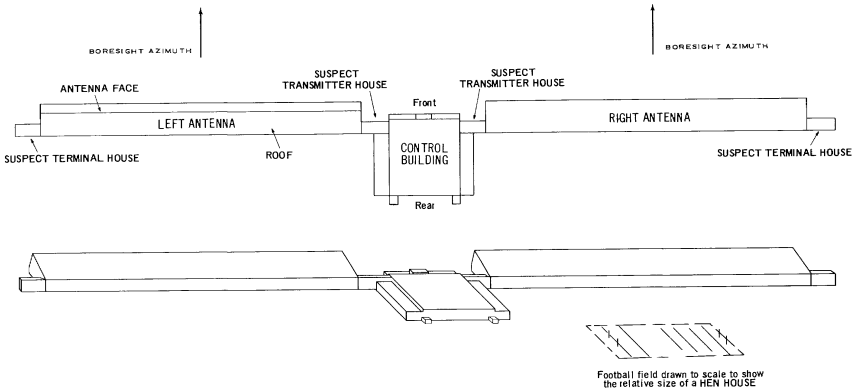


FIGURE 2. PERSPECTIVE VIEW OF A DUAL HEN HOUSE RADAR WITH TERMINOLOGY ANNOTATIONS.

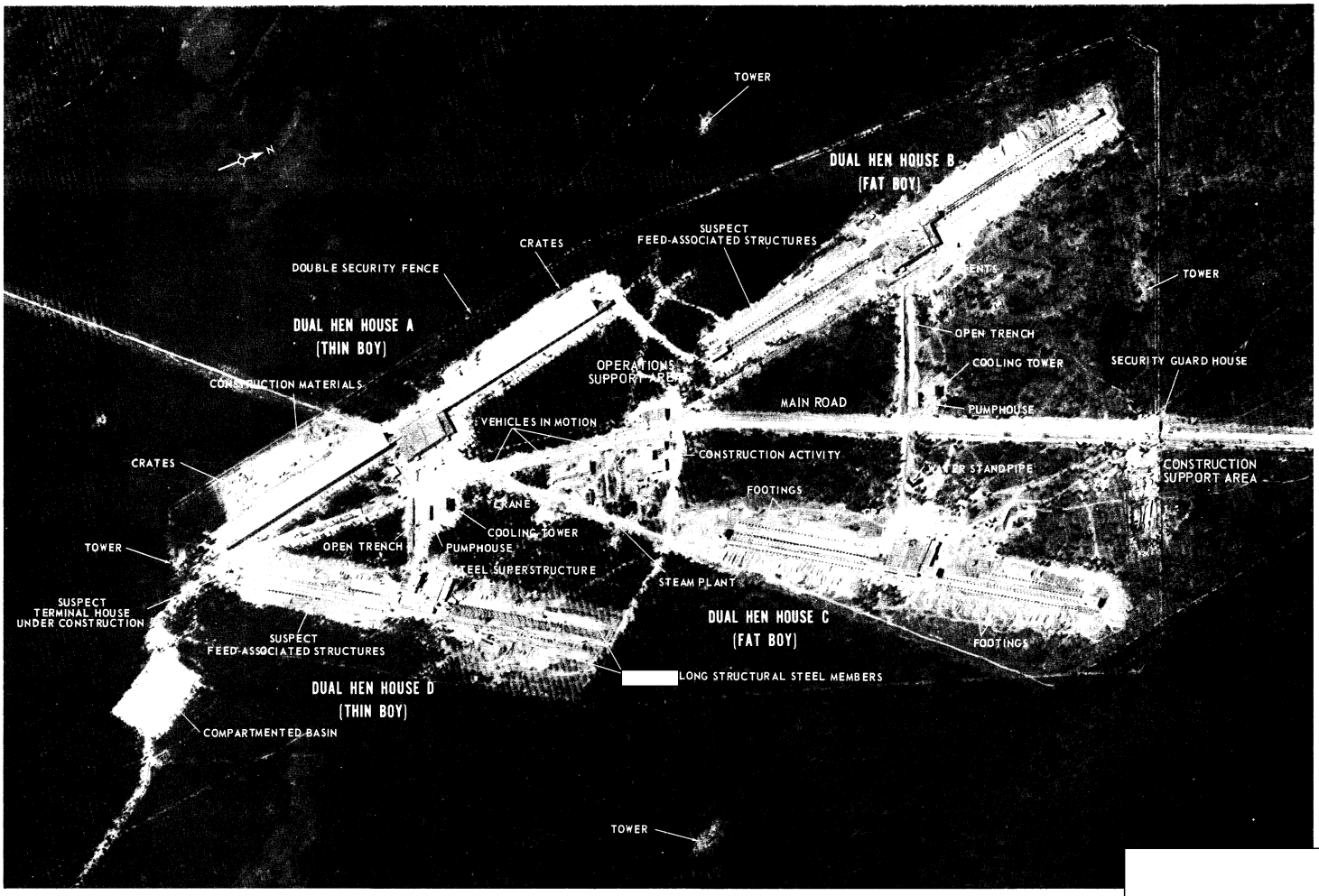
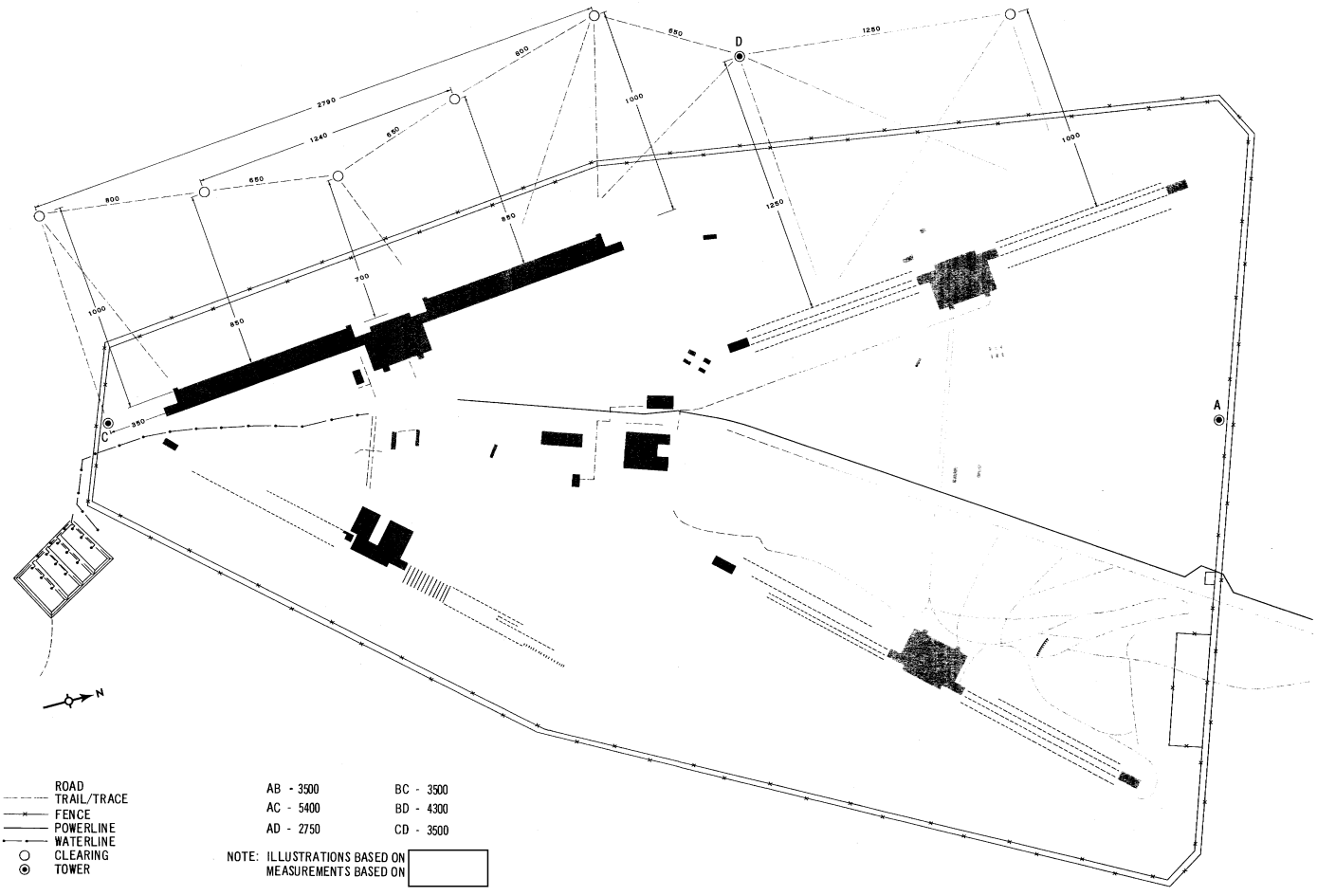


FIGURE 3. MISHELEVKA (ANGARSK) ANTISATELLITE/SPACE TRACKING RADAR COMPLEX OPERATIONS AREA.

25X1



25X1

FIGURE 4. RECTIFIED LINE DRAWING OF THE MISHELEVKA (ANGARSK) ANTISATELLITE/SPACE TRACKING RADAR COMPLEX OPERATIONS AREA.

[redacted] 25X1 25X1

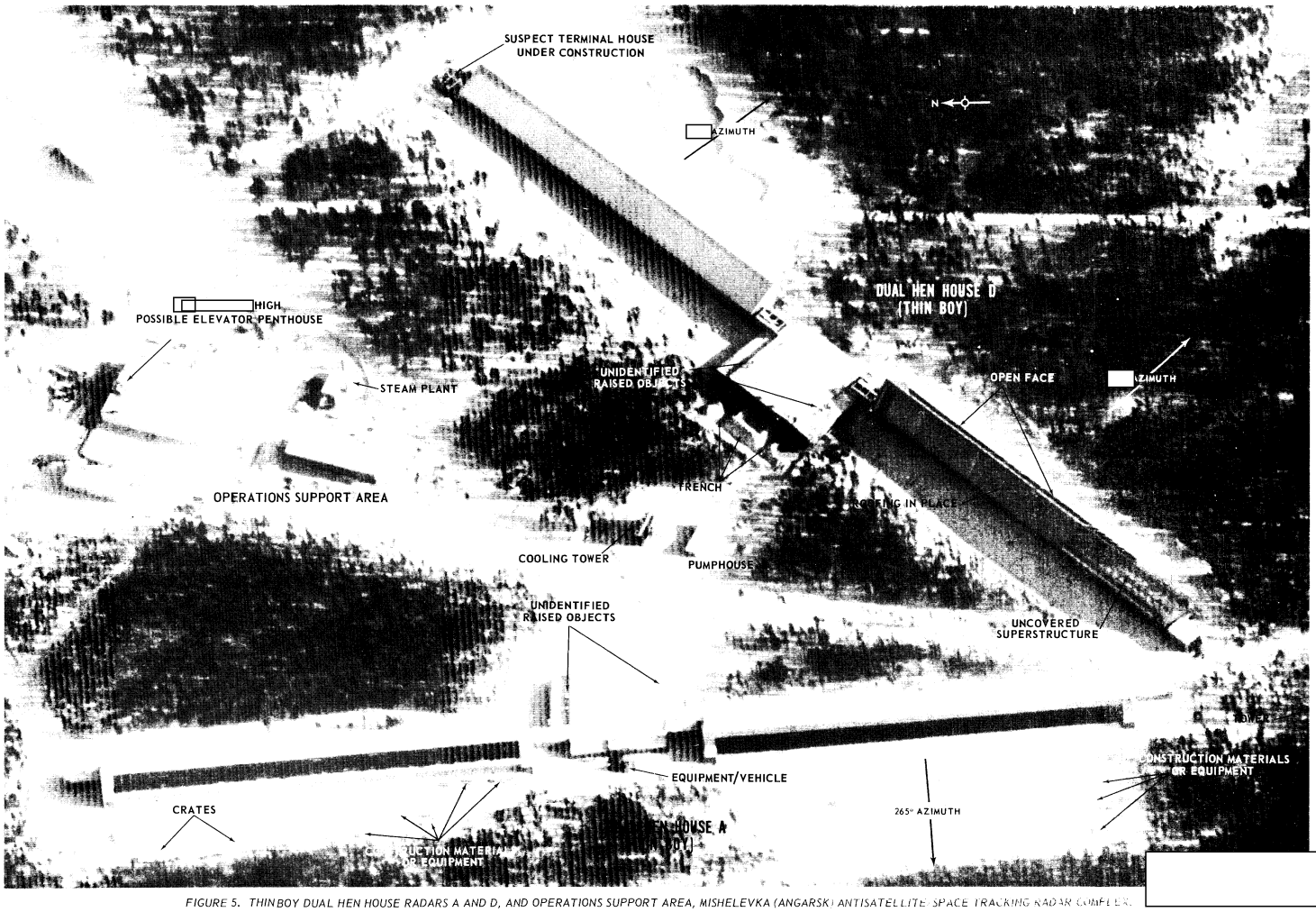


FIGURE 5. THINBOY DUAL HEN HOUSE RADARS A AND D, AND OPERATIONS SUPPORT AREA, MISHELEVKA (ANGARSK) ANTISATELLITE SPACE TRACKING RADAR COMPLEX

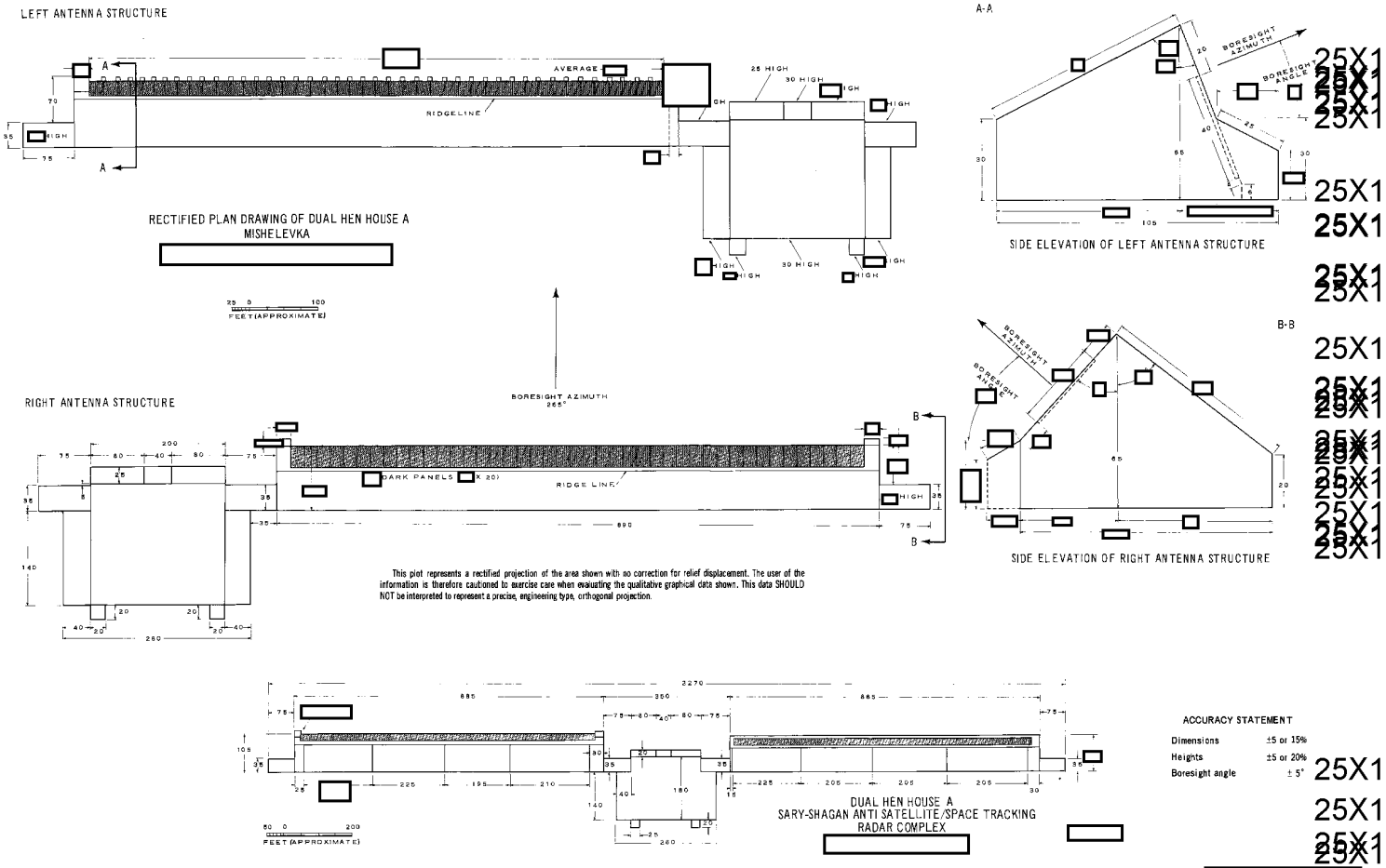


FIGURE 6. ELEVATION AND PLAN VIEWS OF THE MISHELEVKA AND SARY-SHAGAN DUAL HEN HOUSE RADARS A.

25X1 [redacted] the left antenna structure appeared to be under construction and approximately 70 percent of the face appeared to be covered. The roof appeared to be complete. The associated suspect transmitter and terminal houses appeared to have side walls in place. Roofing over these houses was not visible.

The right antenna structure, having a darker overall tone, appeared to be approximately 90 percent covered on the rear slope, 80 to 90 percent covered on the face, and 60 percent covered on the front vertical wall. The suspect transmitter and terminal houses appeared to be at a similar stage of construction as those associated with the left antenna structure (Figure 7).

Photography of [redacted] revealed a uniform gray tone on the overall antenna structures and the right wing appeared to be slightly darker than the left. This variance could be due to the relative angular difference in antenna structures or to a difference in construction stages. The two sets of suspect transmitter and terminal houses appeared to be externally complete, indicating the installation of roofing since Mis-

[redacted]

Further evidence of construction activity in [redacted] was the appearance of a 65- by 35-foot gable-roofed, construction support building approximately 100 feet south of the rear corner of the control building. This building was removed between [redacted] and

[redacted]

[redacted] revealed the face of both antenna structures at a more favorable angle than on previous photography. The south portion of the left antenna face had possibly received some additional covering; however, an opening was still present. The right antenna structure appeared to be completely covered. Rows of construction materials were present in front of both antenna structures.

On [redacted] photography, both antennas were free of snow and the roofs were gray in tone. A prominent dark striation, perpendicular to the long axis of the roof, was noted on the roof of the left antenna structure, approximately 280 feet from its southern end.

[redacted] photography revealed the presence of either openings or black panelling on the face of the right HEN HOUSE structure. This was substantiated seven days later by [redacted] The dark area on the right antenna face extended for [redacted] feet on the 890-foot long wing, leaving a light-toned, 25-foot border at either end. Although the left antenna face was only partially visible, approximately 175 feet on the south end and 85 feet on the north end appeared to be either open or covered with black panels. Two 20- by 20-foot extensions or ells had been added to the front corners of the left antenna structure, possibly serving as entrance points into the structure.

On the roof of the right HEN HOUSE structure, seven dark striations were noted, but in contrast, only one striation, light in tone, was visible on the roof of the left HEN HOUSE. The inconsistency in the locations of these striations as observed on different [redacted] missions can not be explained by interpretation of available photography.

The possible presence of two openings in the rear wall of the control building was indicated, each of which was located above one of the two 20- by 20-foot extensions (Figure 12). An unidentified object was visible on top of the right extension.

Photography of [redacted] revealed the face of the left antenna structure to be 95 percent black toned. Also visible were extensions or ells on each front corner of the right HEN HOUSE structure similar to those present on the left antenna structure.

A favorable camera angle on [redacted] photography of [redacted] confirmed that the face of the left antenna structure was black toned with the exception of a 40- by 30-foot section on the south end which appeared to be gray in tone.

A detailed view of each antenna face, obtained from [redacted] revealed that the face of the left HEN HOUSE was divided into 43 separate 40- by 20-foot, vertical sections or panels, 41 of which were black in tone. The two southernmost sections were gray in tone. Light, drifted snow on the black face showed the individual panels to be horizontally striated in a washboard texture (Figure 5). The right antenna face was also divided into 43 separate, vertical sections or panels, all of which

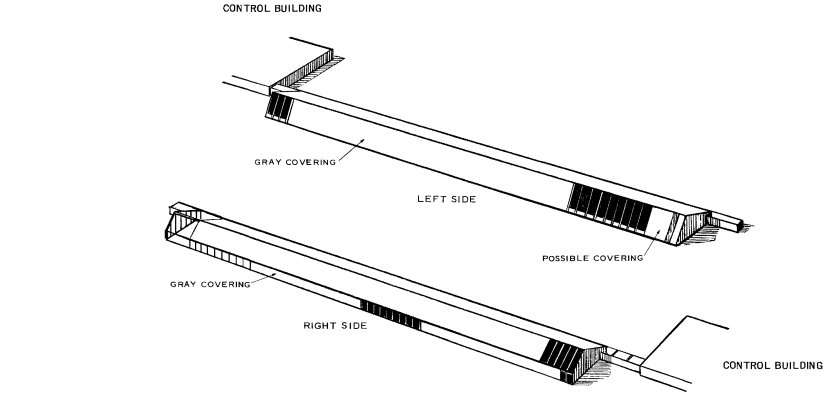


FIGURE 7. PERSPECTIVE VIEW OF THE MISHELEVKA DUAL HEN HOUSE A.

[redacted]

[redacted]

appeared to be black in tone with a horizontally striated washboard texture. On the right antenna face, each panel was 20 feet wide by [redacted] high and appeared to be recessed into the face at different relative depths, a characteristic uncommon to the panels on the left HEN HOUSE.

DUAL HEN HOUSE B

As observed on [redacted], Dual HEN HOUSE B (Figures 10 and 11) appeared to be in an earlier stage of construction than Dual HEN HOUSE A, although in a more advanced stage than either Dual HEN HOUSEs C or D. The central control building was seen under construction with a 75- by 70-foot segment remaining open at the rear. Preliminary construction was underway for the suspect transmitter and terminal houses and rows of footings were visible in each antenna foundation. Suspect feed-associated structures, "piano keys", had been installed within the central channel of the left wing.

Photography of [redacted] revealed major construction progress with the probable external completion of the control building, the erection of the suspect transmitter and terminal houses on the left wing, and the construction of the transmitter house for the right wing. The right wing suspect terminal house was probably also under construction at that time. Further evidence of continuing construction during the winter months can be seen in the dark earth scarring observed along the central portion of the foundation for the right wing indicating activity following the most recent snowfall.

[redacted] photography, a new trench could be seen paralleling the left HEN HOUSE antenna, extending from a point behind the center of the antenna, southward for 720 feet to the vicinity of the site access road where it probably joins the existing trench system.

[redacted] photography, the presence of the suspect transmitter and terminal houses was confirmed. These houses at Dual HEN HOUSE B, designated FAT BOY, are 10 feet wider and 25 feet longer than their counterparts at Dual HEN HOUSE A, designated THIN BOY. "Piano keys," had been installed

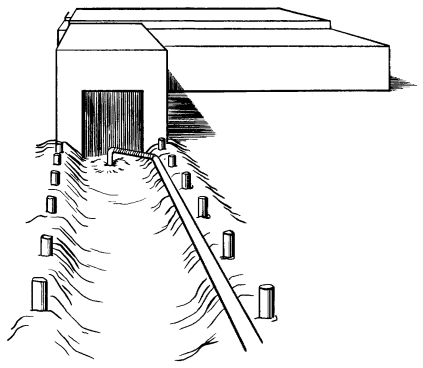


FIGURE 8. PERSPECTIVE VIEW OF THE CONDUIT-LIKE FEATURE AT MISHELEVKA DUAL HEN HOUSE B.

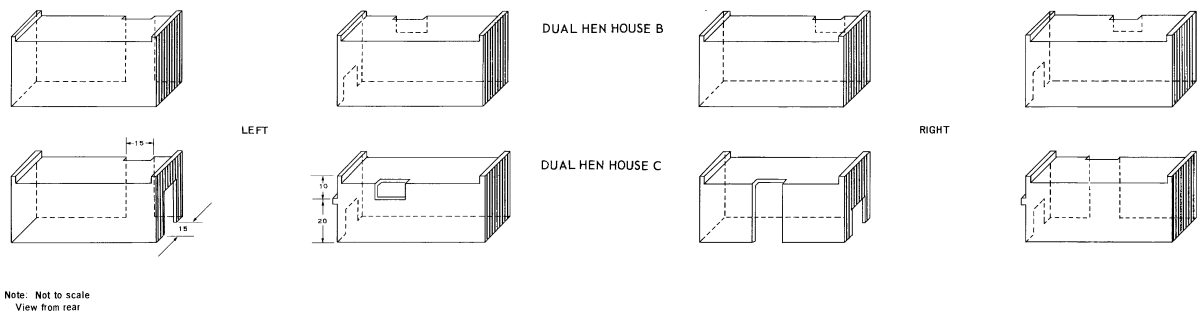


FIGURE 9. COMPARATIVE DRAWINGS OF OPENINGS OBSERVED IN SUSPECT TRANSMITTER AND TERMINAL HOUSES AT MISHELEVKA DUAL HEN HOUSE RADARS B AND C.

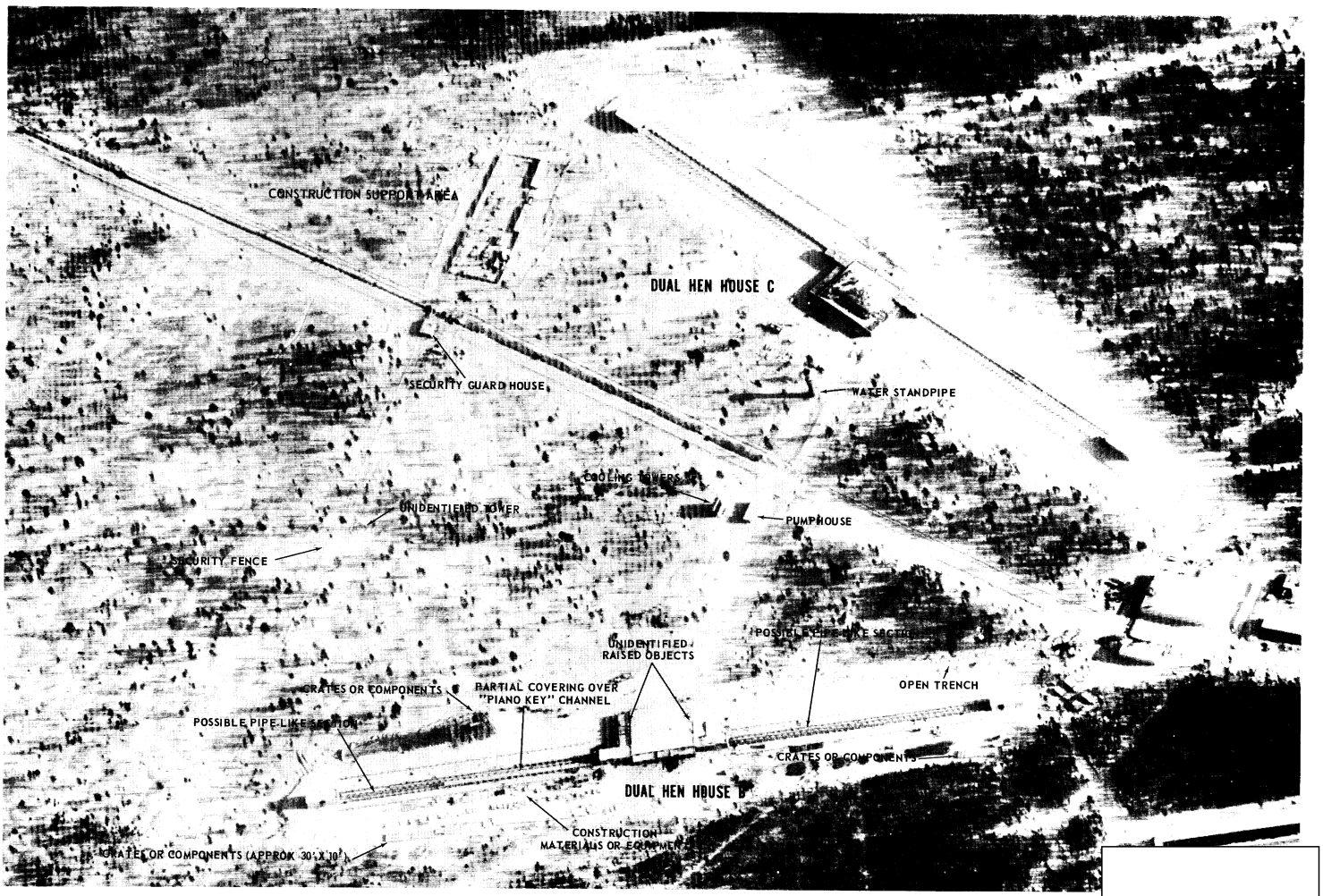
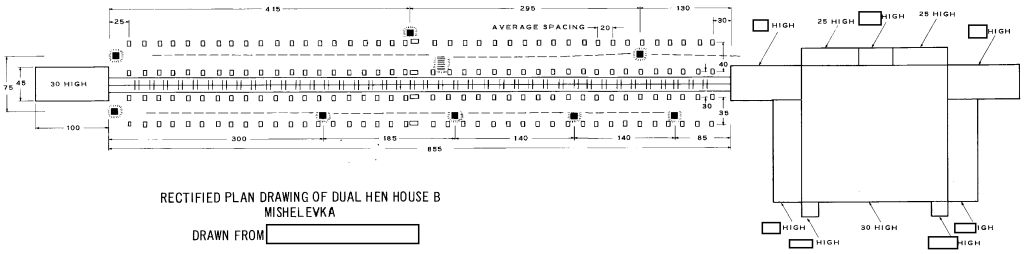


FIGURE 10. FATBOY DUAL HEN HOUSE RADARS B AND C, MISHELEVKA (ANGARSK) ANTISATELLITE/SPACE TRACKING RADAR COMPLEX.

25X1

LEFT ANTENNA STRUCTURE



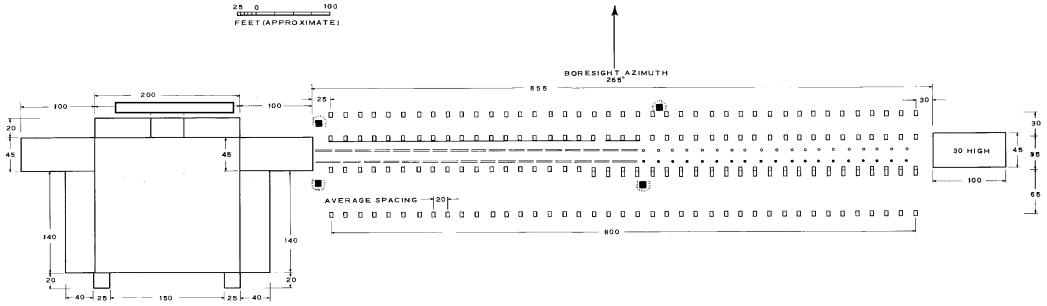
RECTIFIED PLAN DRAWING OF DUAL HEN HOUSE B
MISHELEVKA

DRAWN FROM [redacted]

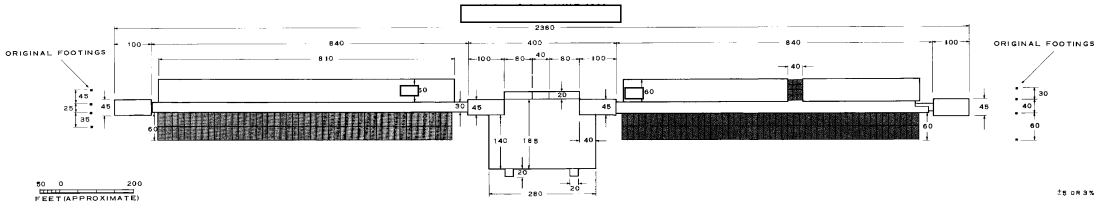
25X1

25 0 100
FEET (APPROXIMATE)

RIGHT ANTENNA STRUCTURE



DUAL HEN HOUSE B
SARY-SHAGAN ANTISATELLITE/SPACE TRACKING
RADAR COMPLEX



ACCURACY STATEMENT

Dimensions	±5 or 15%
Heights	±5 or 20%
Boresight angle	±5°

This plot represents a rectified projection of the area shown with no correction for relief displacement. The user of the information is therefore cautioned to exercise care when evaluating the qualitative graphical data shown. This data SHOULD NOT be interpreted to represent a precise, engineering type, orthogonal projection.

FIGURE 11. ELEVATION AND PLAN VIEWS OF MISHELEVKA AND SARY-SHAGAN DUAL HEN HOUSE RADARS B.

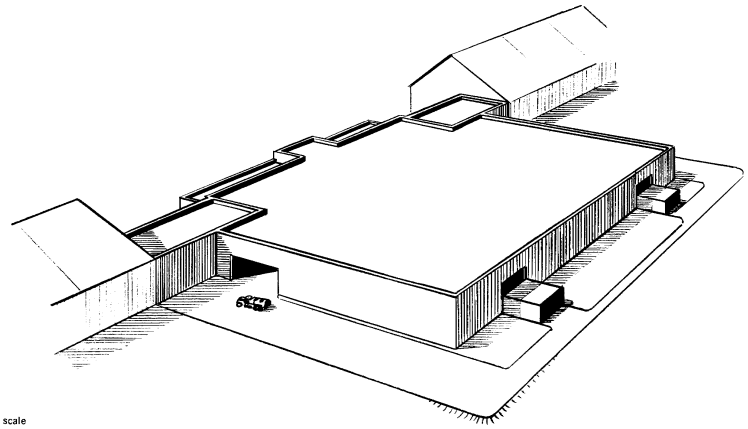
installed within the central channel of the right foundation.

Two 20-foot extensions, similar to those on the control building at Dual HEN HOUSE A, had been added to the rear wall of the control building.

25X1 Photography of [redacted] revealed the extension of the new trench at the rear of the left antenna foundation for several hundred feet northward toward the control building. When next observed 25X1 on [redacted] the trench had been extended to a point adjacent to the rear wall of the control building.

25X1 A more comprehensive analysis of the structural details was possible from very good quality [redacted] photog- 25X1 raphy of [redacted] Although no major construction progress was noted, it was confirmed that the control building was externally complete, and the suspect transmitter and terminal houses, with the exception that the houses still contain small openings in the side walls as shown in Figure 9, were also externally complete.

Four parallel rows of footings were visible at both antenna foundations, each row containing 41 footings spaced at approximate 20-foot intervals. The shapes of individual footings could not be resolved; however, it was noted that the outer rows of footings at each wing were set on a lower ground plane than the inner rows. A buttressed or reinforced channel, 30 feet in width, was present between the center rows of footings on the left antenna foundation. Within this channel were the suspect "piano keys," feed-associated structures (Figure 3). A significant difference exists between these "piano keys" at Dual HEN HOUSE B, designated FAT BOY, and those corresponding structures at Dual HEN HOUSE D, designated THIN BOY. At Dual HEN HOUSE B, the 41 "piano keys" are laterally aligned between the inner rows of footings at 20-foot intervals, whereas at Dual HEN HOUSE D, the "piano keys" are positioned at 10-foot intervals (Figure 16). Along the rows of footings at both antenna foundations were seen a series of unidentified excavations as depicted in Figure 11.



Note: Not to scale

FIGURE 12. PERSPECTIVE VIEW OF COMPLETED CONTROL BUILDING, SARY-SHAGAN DUAL HEN HOUSE A. [redacted]

No additional progress was noted at Dual HEN HOUSE B until [redacted] at which 25X1 time a new ditch was first observed. This ditch originated in the construction area in front of the control building and extended north-northwest for approximately 1,000 feet, and terminated in a wooded area outside the security fence. Some probable construction equipment was observed alongside the ditch; the function of this ditch cannot be determined from available photography.

[redacted] photography of [redacted] 25X1 provided a large-scale view of Dual HEN HOUSE B (Figure 10), allowing further detailed analysis of antenna construction. Progress was visible on the right antenna foundation. Between the two center rows of footings, a light-toned covering had been installed over 480 feet of the central "piano keys" channel. This roofing covered only half the width of the central channel. Also newly observed was an unidentified, conduit-like feature which appeared to be supported against the rear inner slope of each "piano keys" channel. Probably extending along the total length of the left antenna channel, the object appears to angle downward at the entrance to the suspect transmitter house, where it is lost from view at the point the channel extends into the suspect transmitter house (Figure 8).

In the right antenna channel, a similar conduit-like feature is evident for a distance of approximately 680 feet. The area adjacent to the right suspect transmitter house is in shadow; thus the configuration of the conduit-like feature cannot be identified at that point on this photography.

In front of the antenna foundation were approximately 250 miscellaneous probable crates and vehicles. Predominant among these items were approximately 160 unidentified objects, each 30 by 5 feet, parked or placed in pairs 10 feet in width in front of the antenna foundation. Of these 30- by 5-foot objects, 65 pairs were visible near the right wing and the remaining 15 pairs were near the left wing.

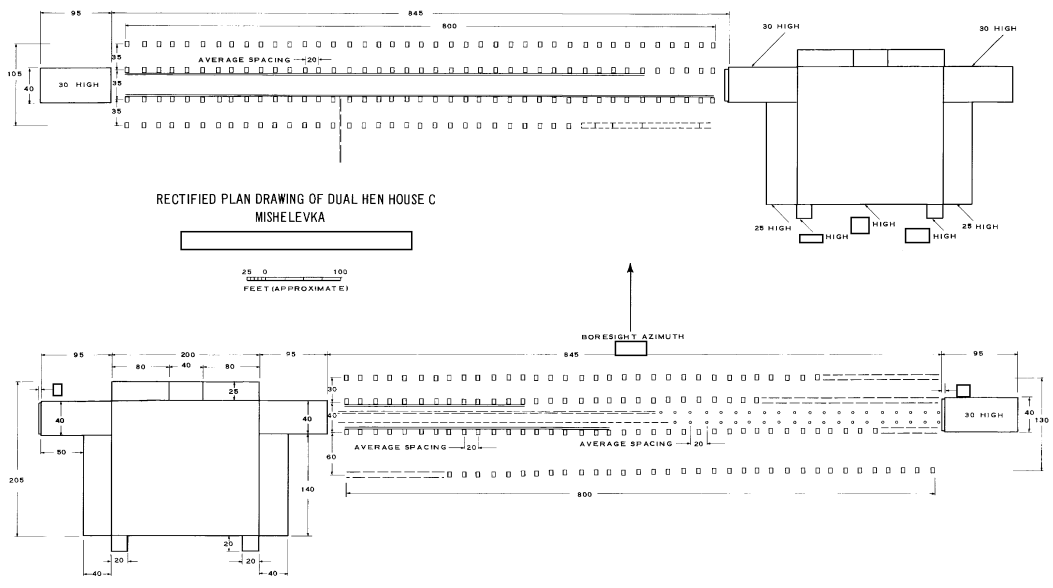
This new activity at Dual HEN HOUSE B is the first evidence of advanced antenna-related construction observed at a FAT BOY Dual HEN HOUSE at either Mishelevka or at Sary-Shagan Antisatellite/Space Tracking Radar Complex.

25X1

[redacted] 25X1
25X1

LEFT ANTENNA STRUCTURE

RECTIFIED PLAN DRAWING OF DUAL HEN HOUSE C
MISHELEVKA
[redacted]



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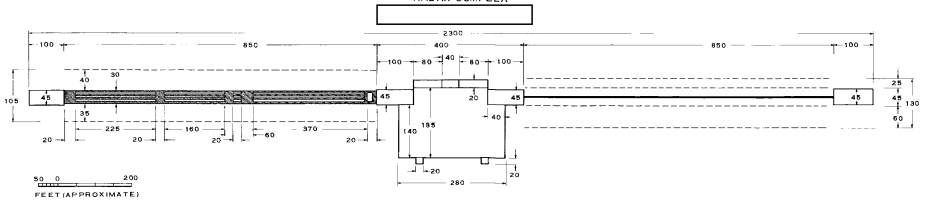
RIGHT ANTENNA STRUCTURE

DUAL HEN HOUSE C
SARY-SHAGAN ANTISATELLITE/SPACE TRACKING
RADAR COMPLEX
[redacted]



25X1

ACCURACY STATEMENT

Dimensions	± 5 or 15%
Heights	± 5 or 20%
Boresight angle	±5°

±5 OF: 3%

This plot represents a rectified projection of the area shown with no correction for relief displacement. The user of the information is therefore cautioned to exercise care when evaluating the qualitative graphical data shown. This data SHOULD NOT be interpreted to represent a precise, engineering type, orthogonal projection.

FIGURE 13. ELEVATION AND PLAN VIEWS OF MISHELEVKA AND SARY-SHAGAN DUAL HEN HOUSE RADARS C.

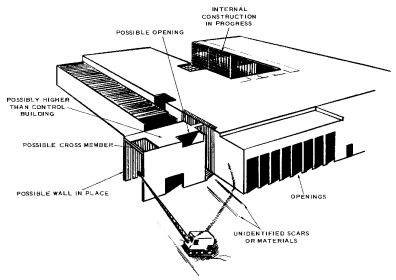
[redacted] 25X1

25X1

DUAL HEN HOUSE C

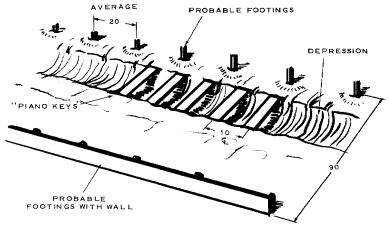
Photography of revealed Dual HEN HOUSE C (Figures 10 and 13) to be in an early stage of construction. Clearings were present for each future antenna foundation, and faint scarring in these clearings indicated that the installation of footings had probably begun. Three separate sections of the control building had been erected; however, no suspect transmitter or terminal houses were evident. On photography, the control building appeared to be approximately 75 percent complete, and was probably externally complete on with the possible exception of a roof section at the rear where construction was underway. Suspect transmitter and terminal houses were in advanced stages of construction on photography.

On large-scale photography permitted a detailed analysis of Dual HEN HOUSE C. Both left and right antenna foundations were constructed in a pattern quite similar to those at Dual



Note: Not to scale

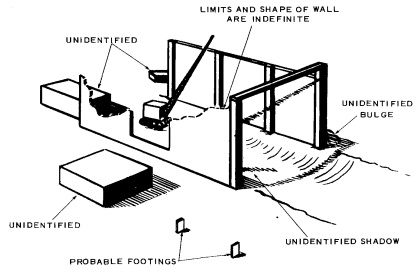
FIGURE 14. PERSPECTIVE VIEWS OF RIGHT SUSPECT TRANSMITTER HOUSE AND CONTROL BUILDING UNDER CONSTRUCTION AT MISHELEVKA DUAL HEN HOUSE D.



Note: Not to scale

All dimensions in feet (approximate)

FIGURE 16. PERSPECTIVE VIEW OF FEED-ASSOCIATED STRUCTURES (PIANO KEYS) AT MISHELEVKA DUAL HEN HOUSE D.



Note: Not to scale

FIGURE 15. PERSPECTIVE VIEW OF RIGHT SUSPECT TERMINAL HOUSE UNDER CONSTRUCTION AT MISHELEVKA DUAL HEN HOUSE D.

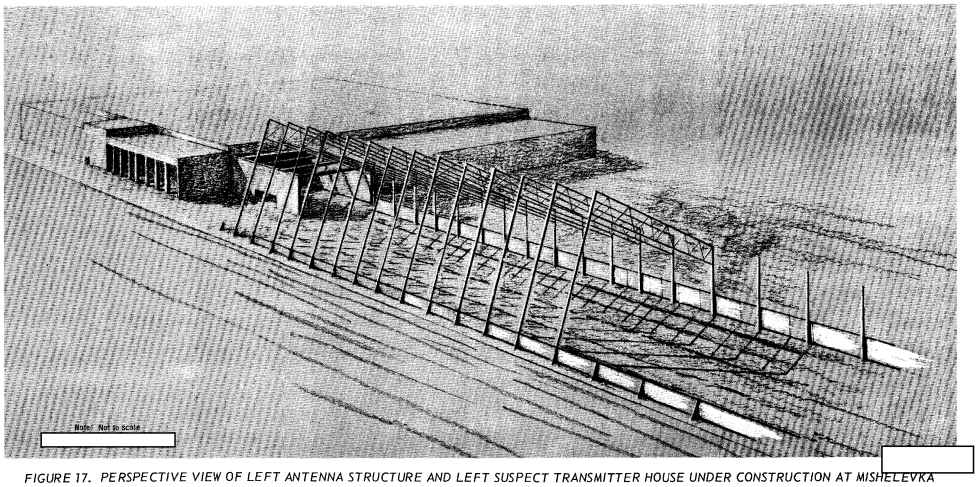


FIGURE 17. PERSPECTIVE VIEW OF LEFT ANTENNA STRUCTURE AND LEFT SUSPECT TRANSMITTER HOUSE UNDER CONSTRUCTION AT MISHELEVKA DUAL HEN HOUSE D.

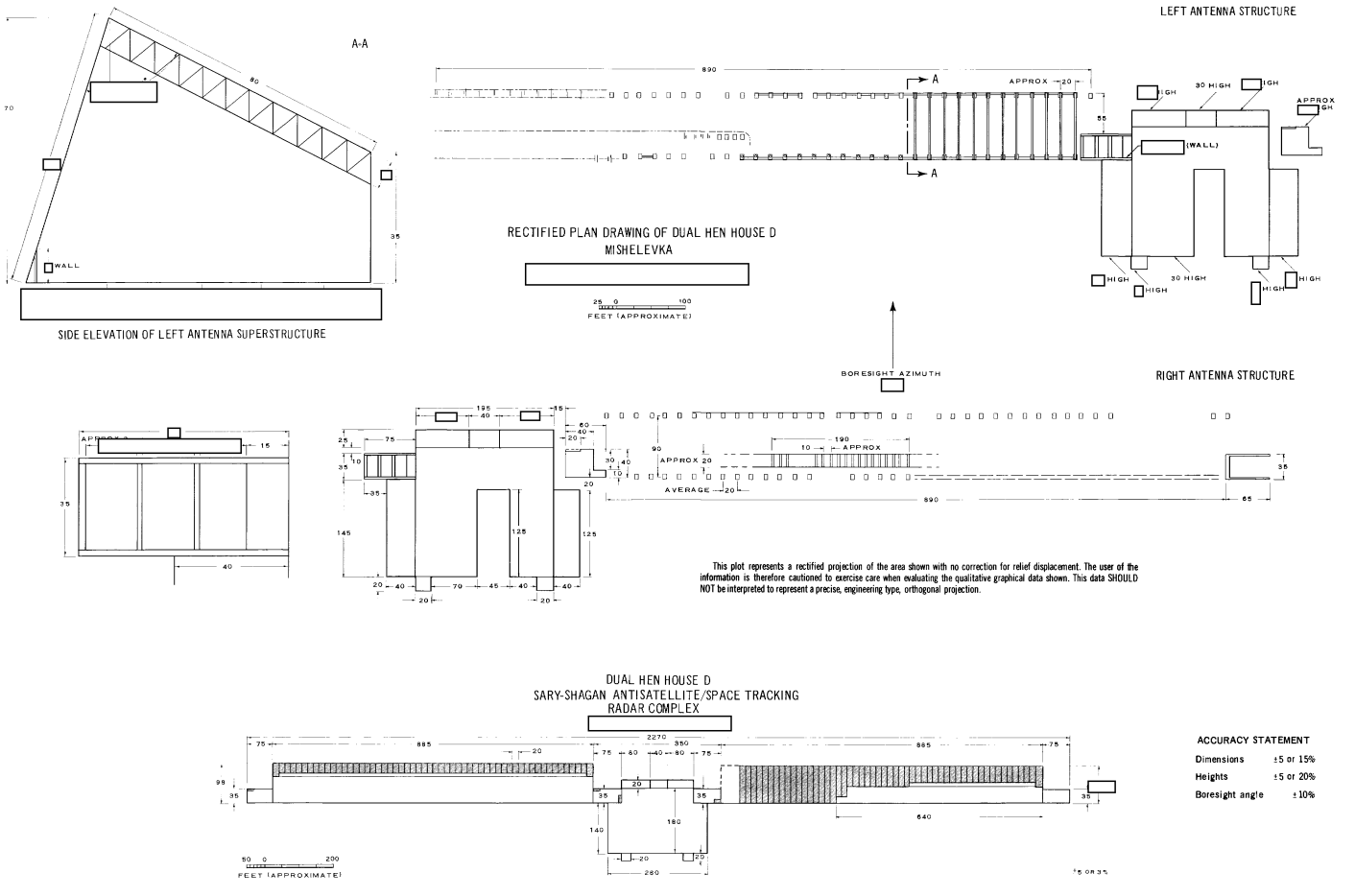


FIGURE 18. ELEVATION AND PLAN VIEWS OF DUAL HEN HOUSE RADARS D AT MISHELEVKA AND SARY-SHAGAN.

HEN HOUSE B and the width of the right foundation was greater than the left.

Four parallel rows of 41 individual footings were present within each antenna foundation. The inner two rows were closely aligned with the side walls of their respective suspect transmitter and terminal houses and appeared to support the sides of the "piano keys" channel which ran between the houses. This central channel contained two parallel rows of smaller footings. Protruding over the northern entrance to the right suspect terminal house and to the left suspect transmitter house was an eave or an ell, the purpose of which could not be determined from available photography (Figure 13).

No construction progress was observed on the three subsequent [redacted] missions; however, on [redacted] the Mishelevka Complex was photographed by a large-scale [redacted] mission. Little or no change had occurred at Dual HEN HOUSE C, and as of [redacted] this radar was the least advanced of the four Dual HEN HOUSE radars under construction. However, it was noted on this mission that the individual footings on both foundations in each of the four rows progressively increase in height from the suspect transmitter house toward the suspect terminal house. The height difference between the shortest and tallest footing in each row is approximately [redacted] Also, on this mission, a new ground scar in the snow was observed extending from the rear wall of the left suspect transmitter house for approximately 750 feet to the main road where it possibly joins the existing water pipeline which parallels the road.

DUAL HEN HOUSE D

[redacted] photography, a 2,200- by 200-foot clearing was present in preparation for the construction of Dual HEN HOUSE D (Figures 5 and 18). The clearing had been broadened and faint linear scarring was visible along the long axis of both antenna foundations when next observed on [redacted] photography, and construction was also in progress on the foundation of the control building. [redacted] photography, an increased construction effort was evident at Dual HEN HOUSE D. This consisted of an excavation in prep-

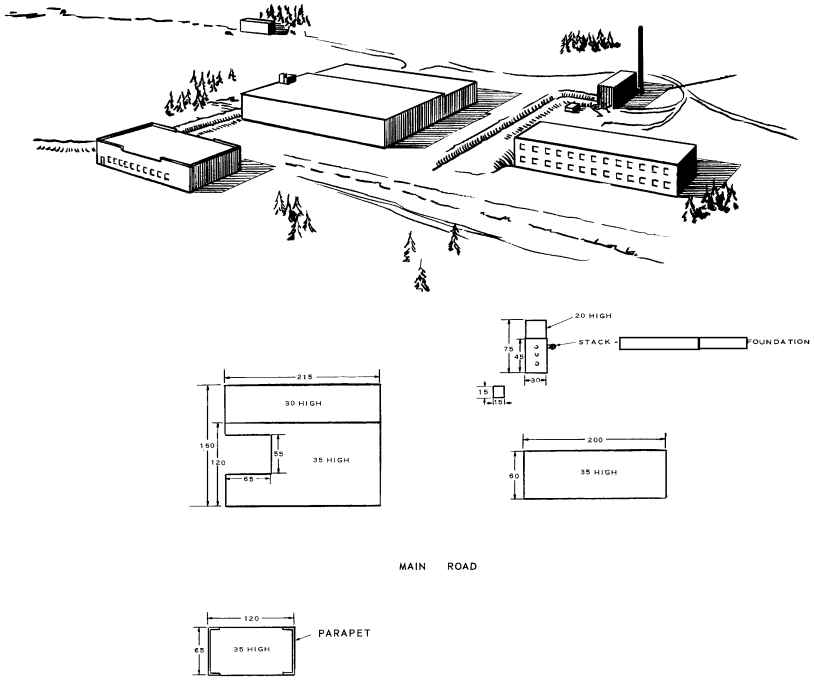


FIGURE 19. PERSPECTIVE AND PLAN VIEWS OF THE OPERATIONS SUPPORT AREA, MISHELEVKA (ANGARSK) ANTISATELLITE/SPACE TRACKING RADAR COMPLEX.

aration for the emplacement of antenna footings. The foundation for the control building was present, and two unidentified rectangular objects were observed near the future site of the left suspect terminal house. Several hundred feet of possible earth scarring was visible in the area of the northern portion of the right antenna foundation, but the scarring was not present when the Mishelevka Complex was next observed on [redacted] The cleared area for the left antenna foundation of Dual HEN HOUSE D had been enlarged to closely match the corresponding clearing for the left antenna at Dual HEN HOUSE A. This increase in cleared area in front of the left antenna of both THIN BOY Dual HEN HOUSES is probably related to a lower boresight angle of elevation.

When observed on [redacted] photography, sections of the control building had been erected. The two previously observed rectangular objects located off the north section of the left antenna foundation were still present, but appeared to have been slightly shifted in position since last seen. Construction of footings had begun at both antenna foundations.

Extensive detail in construction activity at Dual HEN HOUSE D was revealed on [redacted] The control building remained structurally incomplete and construction of the suspect transmitter and terminal houses was in a preliminary stage. At the left antenna foundation, 12 sections of trussed, steel superstructure had been erected. The sections were spaced at 20-foot intervals for a total distance of 240 feet on the 890-foot foundation (Figure 17). At least three construction cranes could be identified at the left foundation, and nine or ten piles of [redacted] long steel members were dispersed around the foundation. The side walls and roof beams of the left suspect transmitter house were present; however, no evidence of construction of the suspect terminal house was observed. At both foundations, the outer rows of footings were incomplete and no inner rows were visible at either foundation. At the right foundation, the suspect transmitter house was under construction and partially roofed (Figure 14). The side walls and roof beams of the suspect terminal house had been erected (Figure 15). Approximately 17 of the suspect feed-associated structures, "piano keys," could be seen spanning the channel between the suspect transmitter and terminal houses at the right antenna foundation (Figure 16) and numerous crates were visible to the rear of the foundation. Detailed elevation and plan views of Dual HEN HOUSE D are provided in Figure 18.

Photography of [redacted] revealed the probable addition of light-toned roofing on the superstructure of the left antenna. Some sections of steel superstructure were possibly erected on the right antenna foundation footings, and the control building was nearly complete.

On [redacted] the left antenna structure appeared complete, and approximately 50 percent of the superstructure had been erected on the right antenna foundation footings. The roof of the left suspect transmitter house and the right suspect terminal house appeared to have been installed.

A unique deep trench, not seen associated with the other control buildings, was at the rear of the control building of Dual HEN HOUSE D between the two 20-foot square extensions (Figure 5).

When observed on photography of [redacted] the control building appeared to be externally complete and the roof of the right wing of the suspect transmitter house had been removed, thus exposing the cross beams. Additional superstructure had been erected on the right antenna footings, and possible black facing or panelling was visible on the left antenna structure. The suspect terminal house for the left antenna appeared to be under construction.

By [redacted] all of the steel superstructure had been erected on the footings of the right wing, and approximately two-thirds of the covering material had been installed on the rear slope. The face of the right wing appeared to be dark from interior shadows observed through the uncovered superstructure.

MISHELEVKA OPERATIONS SUPPORT AREA

Centrally situated within the Mishelevka Operations Area, the Operations Support Area comprises roughly six acres of land and consists of three large support buildings and a probable steam plant (Figures 5 and 19). Several small unidentified structures are also present

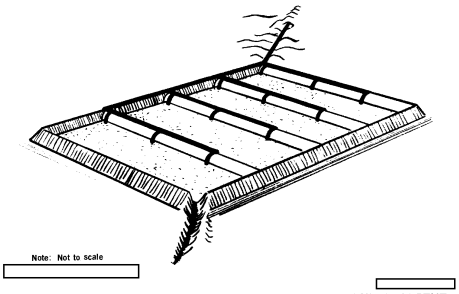


FIGURE 20. PERSPECTIVE VIEW OF THE UNIDENTIFIED BASIN ADJACENT TO THE OPERATIONS AREA, MISHELEVKA ANTISATELLITE/SPACE TRACKING RADAR COMPLEX.

and various items of construction equipment have been observed throughout the area on all photography to date. Excluding the probable steam plant and the smaller structures, approximately 91,000 square feet of floor space is available within the three major buildings.

The largest of the three is a 215- by 160-foot, two level, reinforced concrete support building consisting of a 35-foot high section 215 by 120 feet, and an attached 30-foot high section 215 by 40 feet. The lower section has the appearance of a possible heavy equipment storage area, with large wide doorways in the east wall. If this lower section serves this role, and only one floor is present, 8,600 square feet of floor space should be subtracted from the total figure.

On [redacted] photography, the basic external shell of the large building appeared complete, with the exception of a [redacted] open section remaining in the northern end of the building. Between this photography and [redacted] photography, the opening had been filled. [redacted] [redacted] photography, [redacted] possible elevator penthouse, measuring [redacted] feet, appeared upon the completed roof section. Evidence of possible construction traffic in and out of the wide doorways could be seen.

Approximately 200 feet south of the largest building, a second two level, reinforced concrete support building is present. Measuring 200 by 60 feet and 30 feet high,

25X1 the building appeared to be externally complete on [redacted]
25X1 [redacted] photography, and two rows of windows were visible on each side wall.

The smallest of the three support buildings, appearing 25X1 externally complete on [redacted] photography, is also a two level reinforced concrete support building with a partial parapet roof. The building is 120 by 65 feet and is 35 feet high. At least one row of approximately nine window openings is visible on each long side.

The probable steam plant is in the southeast section of the Operations Support Area and is served by a branch from the trench system which parallels the main road. The plant is 75 by 30 feet, consisting of a 20-foot high lower section, a 30-foot high main section, and a 25X1 [redacted] 25X1 high stack sitting upon a [redacted] base adjacent to the south wall of the high section. Unresolvable objects are against the western wall of the high section.

Several hundred feet northwest of the Operations Support Area are four small closely grouped construction support buildings.

MISHELEVKA CONSTRUCTION SUPPORT AREA

Along the northern span of the security fence, between Dual HEN HOUSE C and the main gate, is a rectangular fenced area containing two vehicle sheds and numerous items of construction equipment and materials.

MISHELEVKA OPERATIONS AREA, MISCELLANEOUS FACILITIES

Midway between the two FAT BOY radars is a bank of cooling towers which is collocated with a pumphouse. A similar facility is midway between the two THIN BOY radars. The cooling tower facility between the FAT BOY radars consists of four square cells or sections, each 25X1 approximately [redacted] by 30 feet high, and the 25X1 cooling tower between the THIN BOY radars contains five 25X1 similar cooling cells. On [redacted] photography, probable cooling fans were visible on top of each cell within both banks of cooling towers, and the associated probable pumphouses each had four probable ventilators on the roof.

Remaining functionally unidentified since its first appearance on [redacted] is a basin containing four equal compartments and located south of Dual HEN HOUSE D, outside the security fence (Figure 20). Access to the area is provided by an extension of the main road. A small structure is present at the northwest corner of the basin, and an outlet trench or pipeline extends from the basin south to a small stream.

A water standpipe with a capacity of 153,000 US gallons is just west of the control building of Dual HEN HOUSE C.

Around the perimeter of the Operations Area are at least four lattice towers, averaging 60 to 65 feet in height (Figure 4). Clearings are located on the west side of the Operations Area, inter-connected by paths, and with trails providing access to and from Dual HEN HOUSES A and B. Perhaps significant is the fact that if an imaginary line were drawn from the center of each HEN HOUSE along the boresight azimuth of both wings of both HEN HOUSE A and B, the line would approximately intersect either a lattice tower or one of the clearings in which a future tower may be placed. This situation was not evident at either Dual HEN HOUSE C or D.

SUPPORT AREAS (Figures 21 and 22)

Previously identified as a probable housing area for construction personnel, Support Area 1 has undergone only minor changes to date. [redacted] large-scale photography revealed this area to contain nine barracks, at least 25 additional unidentified structures of various sizes, and two sports fields. South of the housing area, five probably abandoned building foundations were also seen. Table 1 contains a description, including dimensions, of each structure within this support area.

Support Area 2

As of [redacted] photography, Support Area 2 consisted of a barracks area with associated structures in the western section, three multistory apartment buildings under construction in the eastern section, and a number of unidentified multistory permanent-type buildings in the central section including a steam plant. On [redacted] photography, a 25X1 fourth apartment building was observed under construction, 25X1 and it appeared to be externally complete when seen on [redacted] 25X1

Large scale photography of [redacted] 25X1 revealed Support Area 2 to contain ten barracks-type buildings, four apartment buildings, a steam plant, and at least 35 other structures of various sizes. Two of the wooden barracks had been removed from the western housing area when observed on [redacted] 25X1 [redacted] photography. 25X1

Photography of [redacted] 25X1 revealed a wall separating the portion of the support area east of the main road from that on the west, resulting in the western portion having its access from the main road restricted by the wall and the eastern portion remaining freely accessible from the main road. The steam plant was first observed in operation on [redacted] 25X1 [redacted] photography, and at that time, a fifth apartment building was also observed under construction. 25X1 Table 1 contains a description, including dimensions, of each structure within this support area.

Support Area 3 and Motor Pool

Support Area 3 is situated in the northeast section of the complex, and consists of a housing area, a probable equipment-storage area, and a probable batch plant. It is also collocated with a motor pool.

Although no major changes have occurred in this area, 25X1 two large-scale photographic missions have provided detailed views of the facilities. On [redacted] 25X1 [redacted] approximately 60 or more vehicles were observed 25X1 within the motor pool and numerous crates were present in the storage area to the east. Since that time, several small buildings have been constructed in the support area; otherwise, no significant developments have occurred. Table 1 contains a description, including dimensions, of each structure within this support area and the motor pool.

Personnel Accommodations

Table 2 shows the possible capacity of the personnel accommodations within the Mishelevka Support Areas.

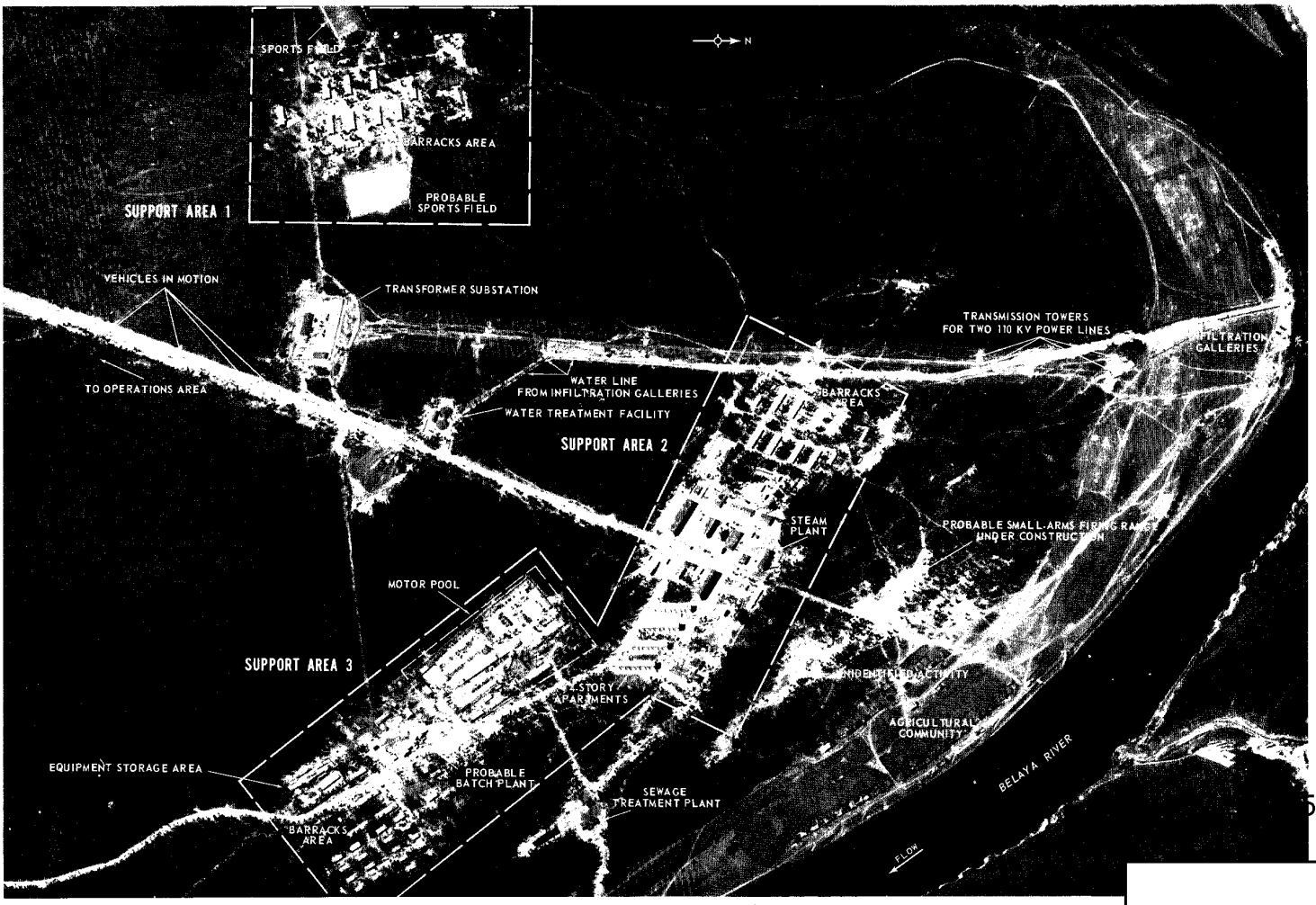


FIGURE 21. SUPPORT AREAS, MISHELEVKA (ANGARSK) ANTISATELLITE/SPACE TRACKING RADAR COMPLEX.

TABLE 1. SUPPORT AREAS

Support Area 1

Item Number	Structure Description	Structure Dimensions (in feet)
1	Support	15 x 15
2	Support	Undetermined
3	Support	Undetermined
4	Support	15 x 15
5	Storage	35 x 25
6	Support	70 x 30
7	Support	40 x 20
8	Support	20 x 10
9a	Storage	100 x 25
b	Storage	30 x 10
10	Support	50 x 25
11	Support, now earth covered	145 x 35
12	Storage	65 x 30
13	Storage	15 x 15
14	Barracks	145 x 40
15	Barracks	145 x 40
16	Barracks	145 x 40
17	Barracks	145 x 40
18	Support	50 x 20
19	Barracks	145 x 40
20	Barracks	145 x 40
21	Barracks	145 x 40
22	Barracks	145 x 40
23	Barracks	155 x 40
24	Support	65 x 25
25	Support	50 x 25
26	Storage	50 x 30
27	Support, now earth covered	145 x 35
28	Storage	130 x 20
29	Storage	25 x 25
30	Storage	25 x 20
31	Storage	40 x 20
32	Support	70 x 30
33	Support	45 x 20
34	Support	20 x 20
35	Foundation	40 x 15

Note: Item numbers are keyed to Figure 22. All structures are one story.

Support Area 2

Item Number	Structure Description	Structure Dimensions (in feet)	Stories
1	Barracks	145 x 40	1
2	Support	15 x 15	1
3	Support	30 x 20	1
4	Support	65 x 35	1
5	Barracks	145 x 40	1
6	Barracks	145 x 40	1
7	Barracks	145 x 40	1
8	Barracks	145 x 40	1
9	Barracks	145 x 40	1
10	Barracks	145 x 40	1
11	Support	70 x 30	1
12	Support	105 x 20	1
13a	Support	Undetermined	1
b	Support	Undetermined	1
c	Support	Undetermined	1
14	Storage	25 x 15	1
15	Storage	30 x 15	1
16	Storage	50 x 25	1
17	Storage	100 x 25	1
18	Storage	25 x 20	1
19	Support	105 x 25	1
20a	Support	105 x 30	Var
b	Support	50 x 40	Var
21	Support	Undetermined	1
22	Support	75 x 25	1
23	Support	20 x 20	1
24a	Barracks or Messhall	140 x 40	1
b	Barracks or Messhall	45 x 45	1
25a	Support	60 x 30	1
b	Wall	85 x 85	--
26	Support	80 x 60	Var
27	Support	160 x 45	1
28	Support	80 x 60	1
29	Steamplant	135 x 40	3
30	Stack	95 high	--
31	Storage	65 x 65	Var
32	Support	120 x 40	1
33	Support	130 x 60	1
34	Support	125 x 45	3
35	Storage	20 x 20	1
36	Support	260 x 55	3
37	Guardhouse	20 x 20	1
38	Storage	35 x 15	1
39a	Support	140 x 45	Var
b	Support	50 x 40	Var
40	Support	80 x 50	2
41a	Support	80 x 40	Var
b	Support	40 x 30	Var
42	Support	205 x 40	5
43	Support	110 x 40	1
44	Support	105 x 35	1
45	Barracks	140 x 40	1
46	Support	80 x 45	2
47	Apartment	240 x 40	4
48	Apartment	240 x 40	4
49	Apartment	240 x 40	4
50	Apartment	240 x 40	4
51a	Support	200 x 45	2
b	Support	60 x 50	Var

Note: Item numbers are keyed to Figure 22.

Support Area 3 and Motor Pool

Item Number	Structure Description	Structure Dimensions (in feet)	Stories
1	Vehicle Storage/ Maintenance	115 x 30	1
2	Storage	30 x 20	1
3	Guardhouse	15 x 15	1
4	Storage	35 x 15	1
5	Vehicle shop	60 x 20	1
6	Support	60 x 25	1
7	Support	25 x 20	1
8	Vehicle Storage/ Maintenance	50 x 20	1
9	Vehicle Storage/ Maintenance	165 x 45	1
10	Vehicle Storage	375 x 40	1
11	Storage/Maintenance	40 x 20	1
12	Storage/Maintenance	50 x 30	1
13	Storage/Maintenance	30 x 20	1
14	Storage/Maintenance	85 x 35	1
15	Storage/Maintenance	40 x 25	1
16	Storage/Maintenance	40 x 35	1
17	Support	100 x 35	1
18	Storage	75 x 25	1
19	Storage	65 x 40	1
20	Support	15 x 15	1
21	Support	30 x 25	1
22	Support	55 x 45	1
23	Batch Plant	Undetermined	Var
24	Conveyor	Undetermined	Var
25	Support	30 x 25	1
26a	Support	60 x 50	Var
b	Support	50 x 35	Var
27a	Support	110 x 40	Var
b	Support	50 x 40	Var
28	Support	60 x 25	1
29	Support	50 x 20	1
30	Support	Undetermined	1
31	Support	35 x 20	1
32	Support	40 x 40	1
33	Support	20 x 15	1
34	Support	20 x 15	1
35a	Support	130 x 35	1
b	Support	35 x 35	1
36	Storage	35 x 15	1
37	Storage/Maintenance	135 x 35	1
38	Storage	70 x 20	1
39	Storage	45 x 35	1
40	Support	20 x 15	1
41	Support	35 x 20	1
42	Barracks	145 x 40	1
43	Barracks	145 x 40	1
44	Barracks	145 x 40	1
45	Barracks	70 x 30	1
46	Barracks	70 x 30	1
47	Barracks	50 x 30	1
48	Barracks	50 x 30	1
49	Barracks	50 x 30	1
50	Barracks	70 x 30	1
51	Barracks	70 x 30	1
52	Barracks	50 x 30	1
53	Barracks	50 x 30	1
54	Barracks	70 x 30	1
55	Barracks	70 x 30	1
56	Barracks	70 x 30	1
57	Barracks	70 x 30	1
58	Barracks	70 x 30	1
59	Barracks	70 x 30	1
60	Barracks	70 x 30	1
61	Barracks	70 x 30	1
62	Barracks	70 x 30	1
63	Barracks	50 x 30	1
64	Barracks	50 x 30	1
65	Barracks	50 x 30	1
66	Barracks	50 x 30	1
67	Support	70 x 40	1
68	Support	70 x 30	1

Note: Item numbers are keyed to Figure 22.

25X1

FIGURE 22. LINE DRAWINGS OF SUPPORT AREAS 1, 2, 3, AND MOTOR POOL AT MISHELEVKA (ANGARSK) ANTISATELLITE/SPACE TRACKING RADAR COMPLEX.

[redacted] 25X1

25X1

Table 2. Mishelevka Personnel Accommodations

Structure	Floor Space	Personnel Accommodated		
		At 70 sq ft Per Person	At 100 sq ft Per Person	At 130 sq ft Per Person
Apartments (4 with 4 stories)*	153,600 sq ft*	2195	1536	1180
Barracks	149,800 sq ft	2140	1498	1150
Totals	303,400 sq ft*	4335	3034	2330

25X1 a fifth apartment, containing 38,400 square feet, was under construction

25X1 **Other Support Activities**

25X1 The sewage treatment plant by the Belaya River appeared to be in operation when seen on 25X1 photography, as illustrated by dark tone in the sludge basin. The water treatment facility and the power substation each appeared to be complete and probably in operation. Transmission towers were in place for the two 110-kv powerlines approaching the power substation from the north.

25X1 By photography, a probable small-arms firing range, 900 feet in length, had been constructed between Support Area 2 and the river.

COMPARISON BETWEEN MISHELEVKA AND SARY-SHAGAN ANTISATELLITE/SPACE TRACKING RADAR COMPLEXES

The relative construction timing of the Dual HEN HOUSE radars at both Mishelevka and Sary-Shagan has been quite similar, as recorded in Figure 23, and illustrated by Figures 3 and 24. At both installations Dual HEN HOUSE A (THIN BOY-type) radars were the first of the four radars to appear to be under construction. As construction progressed, the foundation and structural elements continued to reveal similar signatures at both DUAL HEN HOUSE A radars. However, the external structure of Dual HEN HOUSE A at Sary-Shagan was completed in a shorter period of time than its THIN BOY counterpart at Mishelevka.

The computed boresight angles of elevation at both THIN BOY-type Dual HEN HOUSE radars are relatively similar, and the basic structural components equate closely in shape and dimension. The differences in computed angles of elevation are possibly due to photographic system limitations which preclude more precise mensuration. However, the mensuration which has been accomplished to date indicates a difference in vertical dimensions between the black panels on Dual HEN HOUSE A at Sary-Shagan and on Dual HEN HOUSE A at Mishelevka. Although all of these panels are 20 feet wide, those panels on each antenna of Sary-Shagan Dual HEN HOUSE A are 10 to 15 feet higher than the similar panels on Dual HEN HOUSE A at Mishelevka.

Both at Mishelevka Dual HEN HOUSE A and Sary-Shagan Dual HEN HOUSE A, the control buildings are basically similar, with the exception of the vertical dimensions. Whereas at Mishelevka, the main body of the control building appears to be multileveled, its counterpart at Sary-Shagan appears to be single leveled with a parapet roof. This single-level configuration will probably be common to all four radar control buildings at Sary-Shagan (Figure 12). With all four of the control buildings nearly complete at both installations, no evidence of a single-level control building construction has been observed at Mishelevka.

At both Dual HEN HOUSE complexes, radars B and C (FAT BOY-type) and D (THIN BOY-type) are still under construction (Figures 10, 25, and 28). The relative construction progress at both complexes of the incomplete Dual HEN HOUSE radar B, C, and D has followed a similar pattern. At each complex, Dual HEN HOUSE D is nearing external completion, lacking only face panels and sections of roofing. As described previously in this report, a deep trench is at the rear of the control building of Dual HEN HOUSE D, Mishelevka; no evidence of a similar trench has been seen at Sary-Shagan.

At both complexes, each FAT BOY HEN HOUSE designated B has progressed to the point that actual antenna construction is underway (Figure 27). At Mishelevka on 25X1 photography, large quantities of construction equipment and possible crates were in

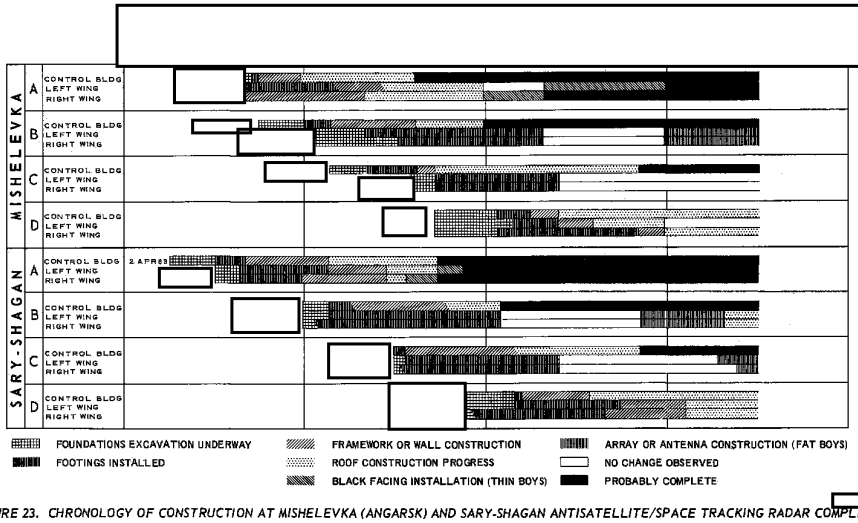


FIGURE 23. CHRONOLOGY OF CONSTRUCTION AT MISHELEVKA (ANGARSK) AND SARY-SHAGAN ANTISATELLITE/SPACE TRACKING RADAR COMPLEXES.

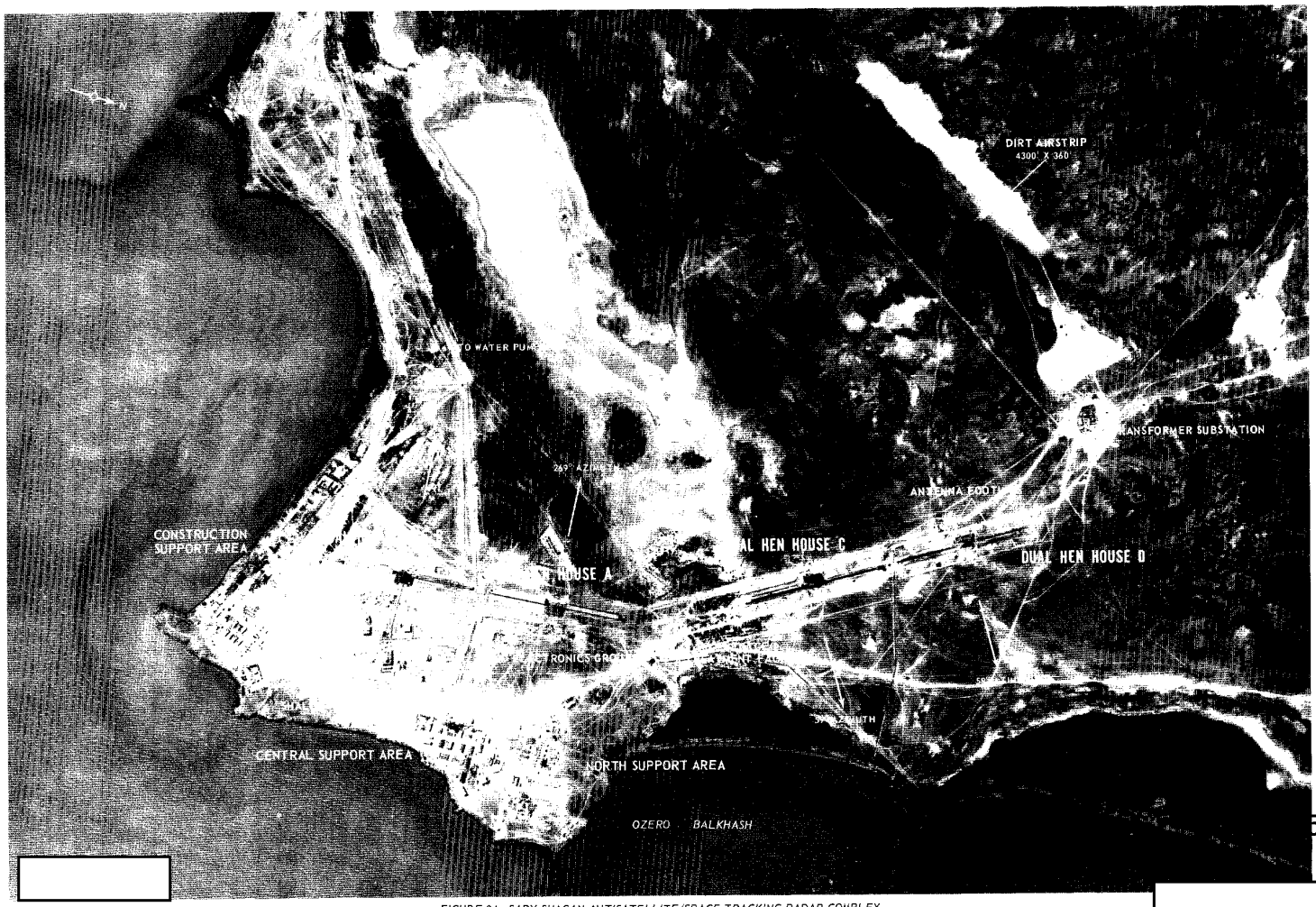
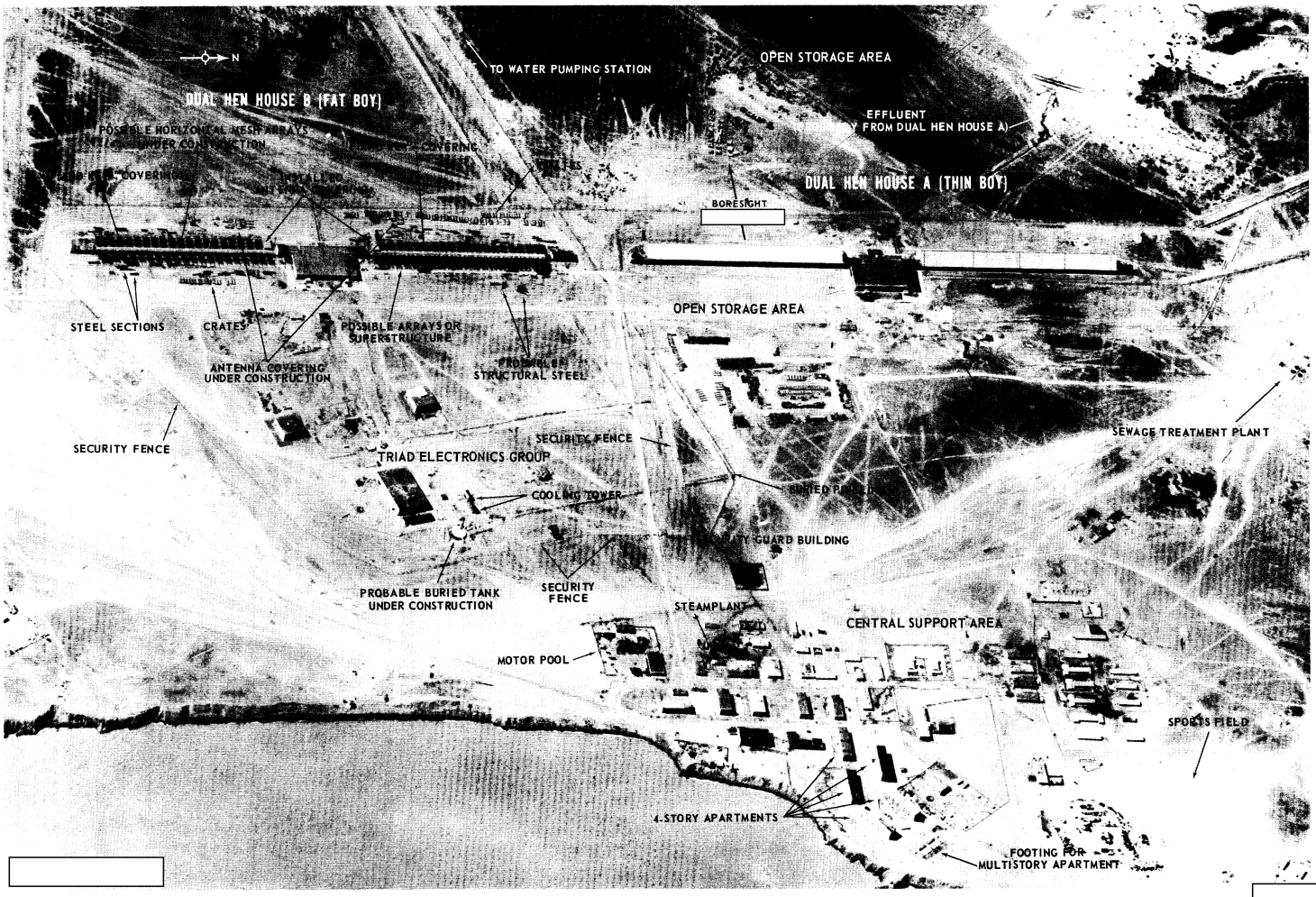


FIGURE 24. SARY-SHAGAN ANTISATELLITE/SPACE TRACKING RADAR COMPLEX.



25X1 25X1 25X1 25X1

FIGURE 25. SARY-SHAGAN DUAL HEN HOUSE RADARS A AND B.

front of the antenna foundations, and an unidentified pipe-like section was observed within each of the two "piano key" channels (Figure 10). Although this pipe-like feature has not been seen at Sary-Shagan Dual HEN HOUSE B, it is impossible to determine whether such a feature was installed, due to advanced construction, as revealed by [redacted] and shown in Figure 25. This photography revealed that the external configuration of the FAT BOY HEN HOUSE radars B and C at Sary-Shagan will be different from that of the THIN BOY Dual HEN HOUSE radars A and D. The same differences will probably apply to the Mishelevka Dual HEN HOUSE radar facilities. The suspect feed-associated structures, "piano keys," at Dual HEN HOUSE radar B are now covered by a raised surface which extends between the suspect transmitter and terminal houses flanking each of the antennas.

Spaced at intervals along each side of the covered, centrally located channel of the suspect feed-associated structures of the left antenna at Dual HEN HOUSE radar B are rectangular, mesh-like arrays which appear to be horizontally mounted over what was previously believed to be footings for vertical structural members. These probably horizontal, mesh-like arrays give the left antenna or antennas a total width of approximately 165 feet, whereas the rows of footings below were spaced 110 feet apart. The mesh-like arrays are connected by a number of lateral members of different thicknessess. Each of the mesh-like sections is approximately 60 feet from east to west and 30 feet from north to south, with the following exceptions:

A. The southernmost, mesh-like array on each side of the central dividing structure is approximately 45 feet in the north to south direction.

B. The northernmost array on the western side of the central dividing structure is not visible as it is covered by a solid, raised surface approximately 60 by 40 feet. A nearby crane indicates that construction is continuing.

A mirror image of the 60- by 40-foot solid raised surface is on the northern antenna of Dual HEN HOUSE B. Construction cranes are nearby. The western side of Dual HEN HOUSE B appears to have a similar arrangement of equally spaced and sized mesh-like arrays positioned along the entire length of the antenna. The space between the sections is not clearly defined. Lateral, continuous members are also present. The pattern along the eastern side of the central structure resembles a series of possibly curved metallic members. Each member is connected at the bottom to the original outer footings, with the other end resting against and rising slightly above the central section which covers the "piano key" channel. The possibly curved members are connected laterally by at least three continuous members running the length of the array. This eastern array gives the impression of a huge, shallow, parabolic trough with the concave portion facing upward at a very high angle of elevation.

TRIAD ELECTRONICS GROUP, SARY-SHAGAN ANTISATELLITE/SPACE TRACKING RADAR COMPLEX

Activity within the Triad Electronics Group at Sary-Shagan Antisatellite/Space Tracking Radar Complex (Fig-

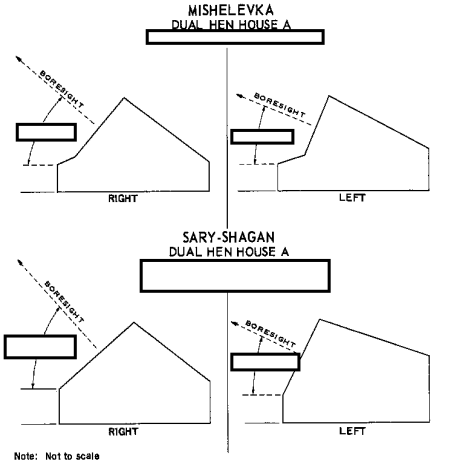


FIGURE 26. COMPARISON OF BORESIGHT ANGLES OF ELEVATION OF DUAL HEN HOUSE RADARS A AT MISHELEVKA AND SARY-SHAGAN.

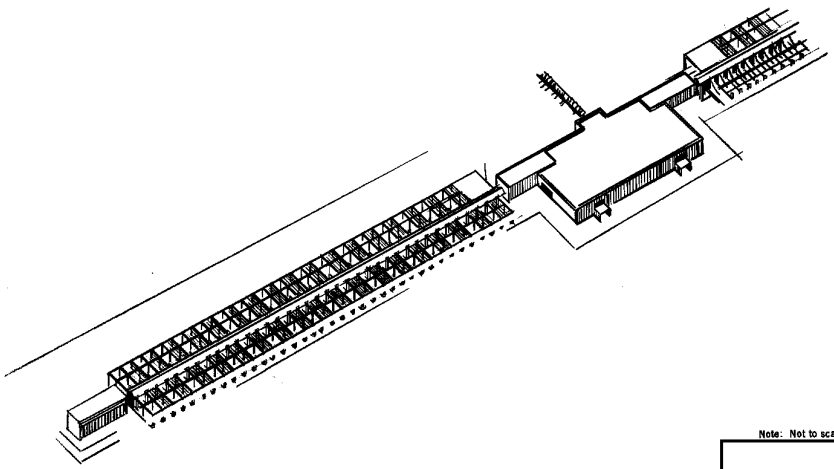


FIGURE 27. PERSPECTIVE VIEW OF SARY-SHAGAN ANTISATELLITE/SPACE TRACKING RADAR COMPLEX DUAL HEN HOUSE B UNDER CONSTRUCTION.

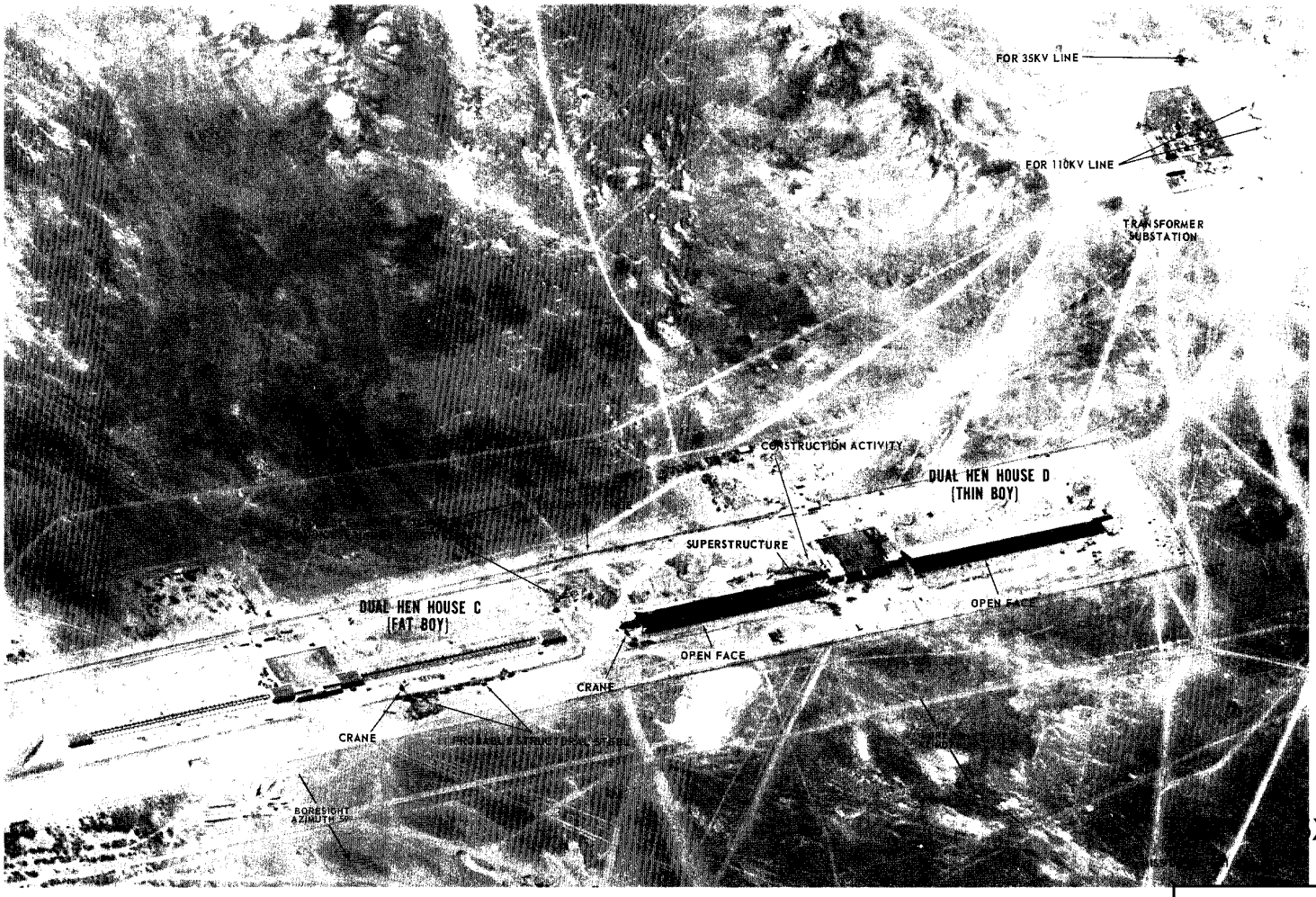


FIGURE 28. SARY-SHAGAN DUAL HEN HOUSE RADARS C AND D

ures 25 and 29) continues; however, there is still no evidence of antenna dishes or associated roof construction similar to that seen at Sary-Shagan Launch Complex B.

The 65-foot diameter semiburied tank, 200 feet east of the large triad building, was first seen on [redacted] photography. Excavation for this tank was started between [redacted], with possible tank construction visible on [redacted] photography. This tank appears to be connected to the adjacent 80- by 20-foot pumphouse. A similar tank is not present at the Mishelevka complex.

There is no photographic evidence of a triad electronics group at Mishelevka, nor is it possible to determine on available photography whether buildings in the Mishelevka Operations Support Area will perform a similar function to that of the buildings within the triad facility at the Sary-Shagan Antisatellite/Space Tracking Radar Complex.

SARY-SHAGAN RADAR COMPLEX 1

HEN HOUSE RADAR

None of the photographic coverages of the Dual HEN HOUSE radars has revealed a completed radar structure at a time when light conditions would permit observation of the features along the back wall of the structure. However, on [redacted] the prototype HEN HOUSE at Sary-Shagan Radar Complex 1 was photographed by [redacted] Mis- [redacted] which provided a good oblique view of the back side of the structure (Figure 30). This view of the HEN HOUSE reveals 23 probable windows, spaced at 40-foot intervals along the back wall. Construction materials in back of the southern end of the structure and the variations in tone on the adjacent HEN HOUSE roof and walls indicate that repairs are in progress.

The presence of approximately 12 vehicles in the support area suggests that the facility is occupied. A fenced microwave station, containing a 20- by 20-foot building and two tower-mounted reflectors, is adjacent to the east side of the support area.

SUSPECT OVER-THE-HORIZON RADAR

There is no positive proof that the "Billboard" feature adjacent to the HEN HOUSE radar is functionally associated with it; however, early construction included ditching from the HEN HOUSE control building toward the area now occupied by the base of the inclined screen. The good oblique view of the suspect over-the-horizon radar on [redacted] shows that the screen is definitely inclined. A ray normal to the face of the screen would have an estimated angle of elevation of approximately [redacted] degrees, [redacted] Five regular segments are seen along the southern edge of the screen, suggesting that the screen is constructed of horizontally stacked sections. The screen is supported from the rear by six equally spaced V-shaped supports, and is offset from the suspect ground plane in a northward direction. Two lattice masts, each estimated to be approximately 185 feet tall, plus or minus 25 feet, flank the inclined screen. The suspect ground plane, located between the inclined screen and the suspect feed house which is 225 feet to the west, appears to be a flat structure approximately [redacted] high. A single story building, approximately [redacted] is behind the northern end of the inclined screen. It is constructed between the screen and the V-shaped supports.

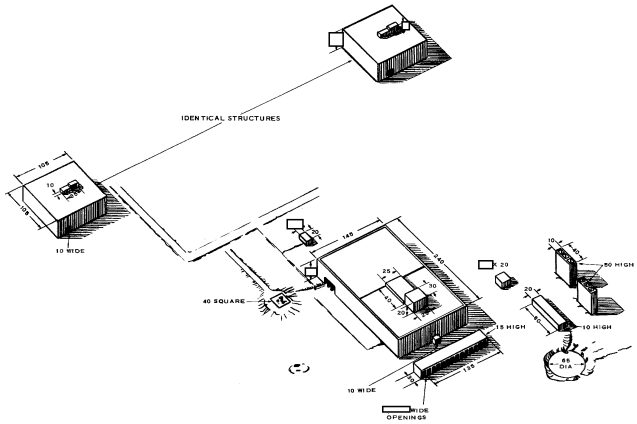
AZIMUTHS OF PROPAGATION

Figure 31 shows the location of azimuths with reference to each site and other geographic features, plotted on a gnomonic chart. (*) In addition to the azimuths from Dual HEN HOUSE installations, this map also shows the boresight azimuths from the prototype HEN HOUSE at Sary-Shagan Radar Complex 1 and the azimuth from the Naro-Fominsk DOG HOUSE probable phased-array radar, assuming that both faces of the DOG HOUSE will contain radar antennas.

These azimuths have been computed to an accuracy of plus or minus one degree.

A study of Figure 31 reveals that boresight azimuths (and some back azimuths) go near or through certain related installations. For example, the boresight azimuth from Mishelevka Dual HEN HOUSE Radars A and B passes very close to Sary-Shagan and that from Sary-Shagan Dual HEN HOUSE C passes close to Mishelevka.

*A straight line on a gnomonic chart represents a great circle arc.



Note: Not to scale [redacted]

All dimensions in feet (approximate)

FIGURE 29. PERSPECTIVE VIEW OF THE TRIAD ELECTRONICS GROUP AT THE SARY-SHAGAN ANTISATELLITE/SPACE TRACKING RADAR COMPLEX.

FIGURE 30. SARY-SHAGAN RADAR COMPLEX 1.

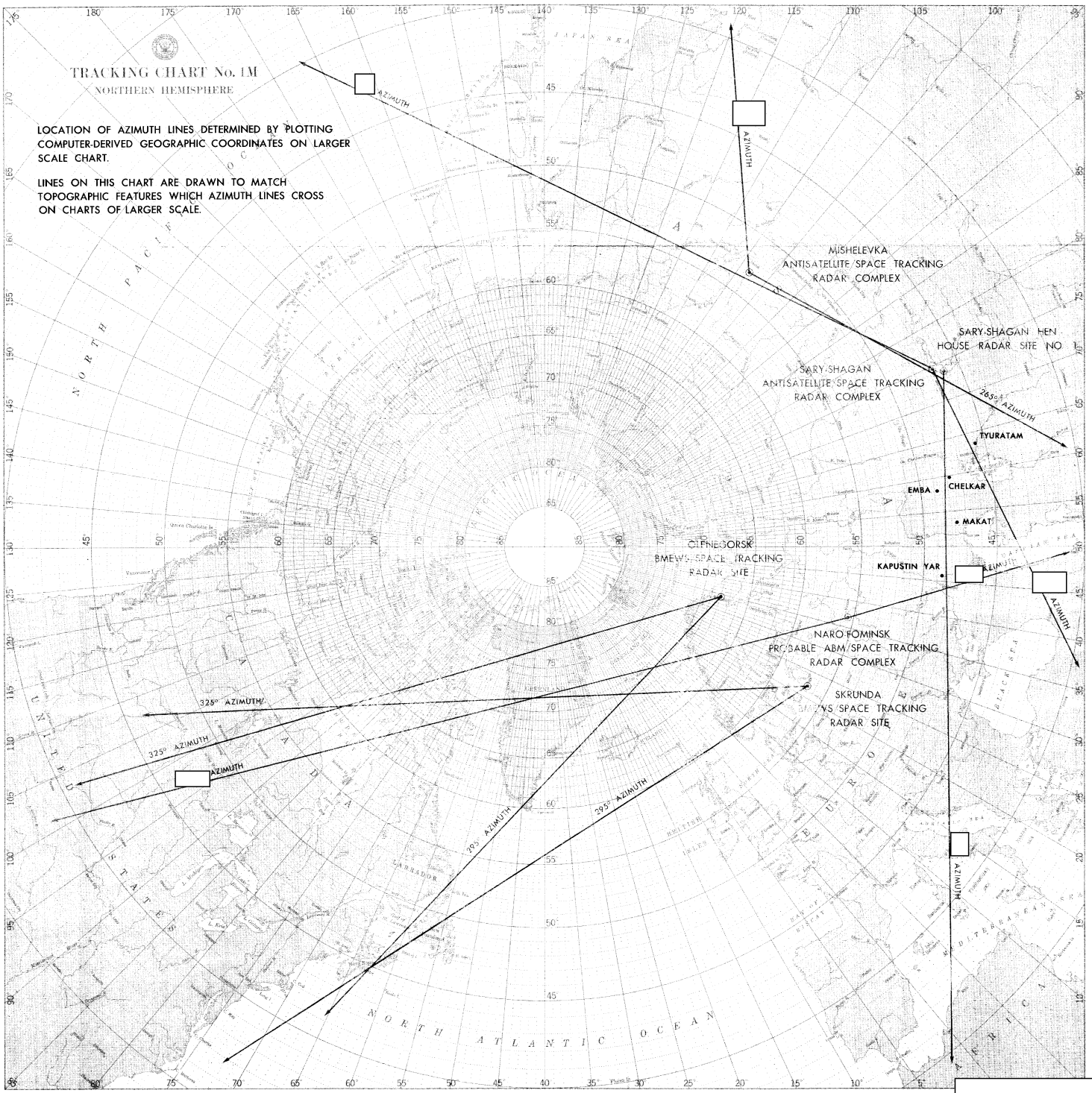
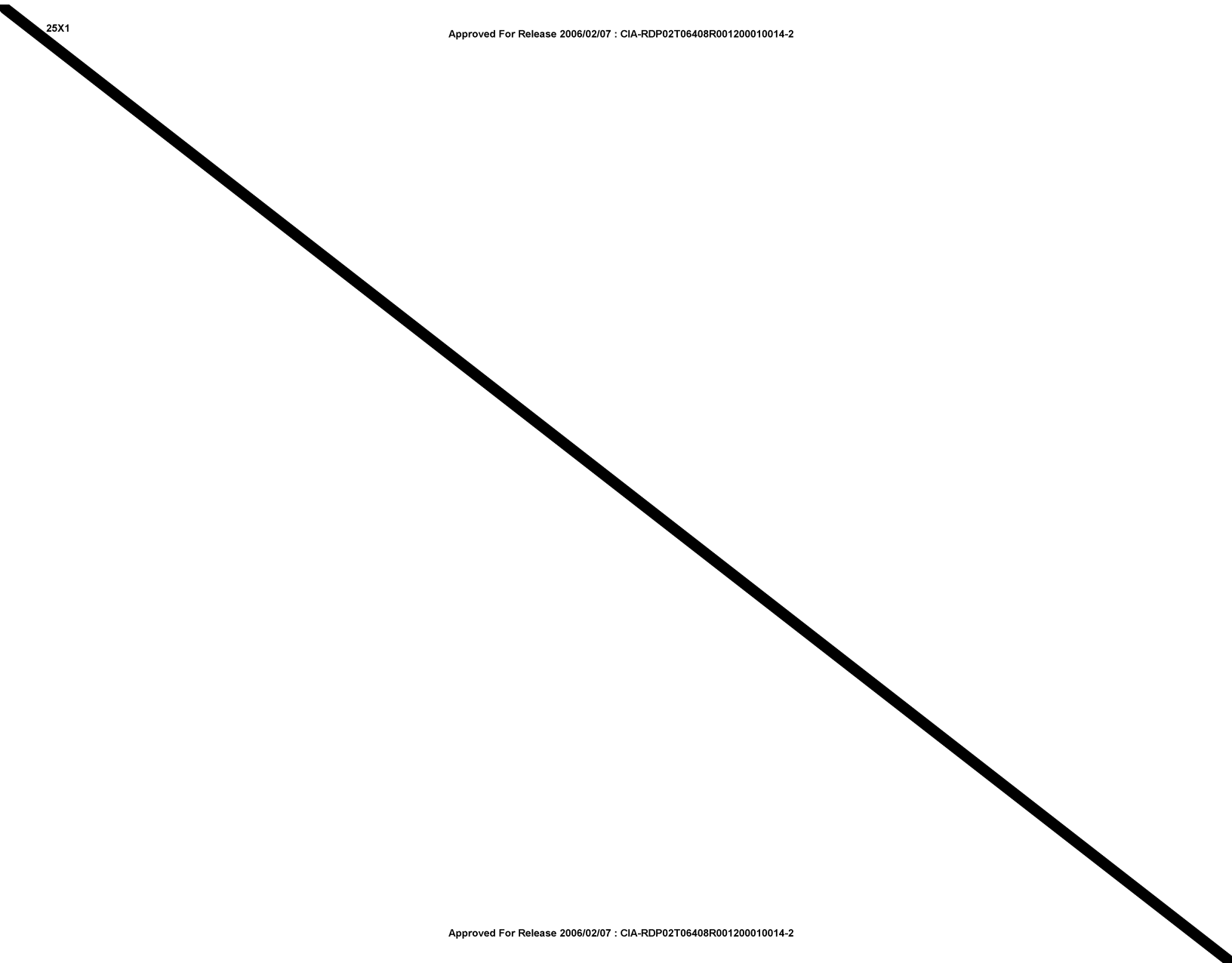


FIGURE 31. ANTENNA BORESIGHT AZIMUTHS.



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REQUIREMENTS

C-SI5-82,970

CZ/51/65

PROJECT

30344-6

30319-6

25X1

TOP SECRET
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